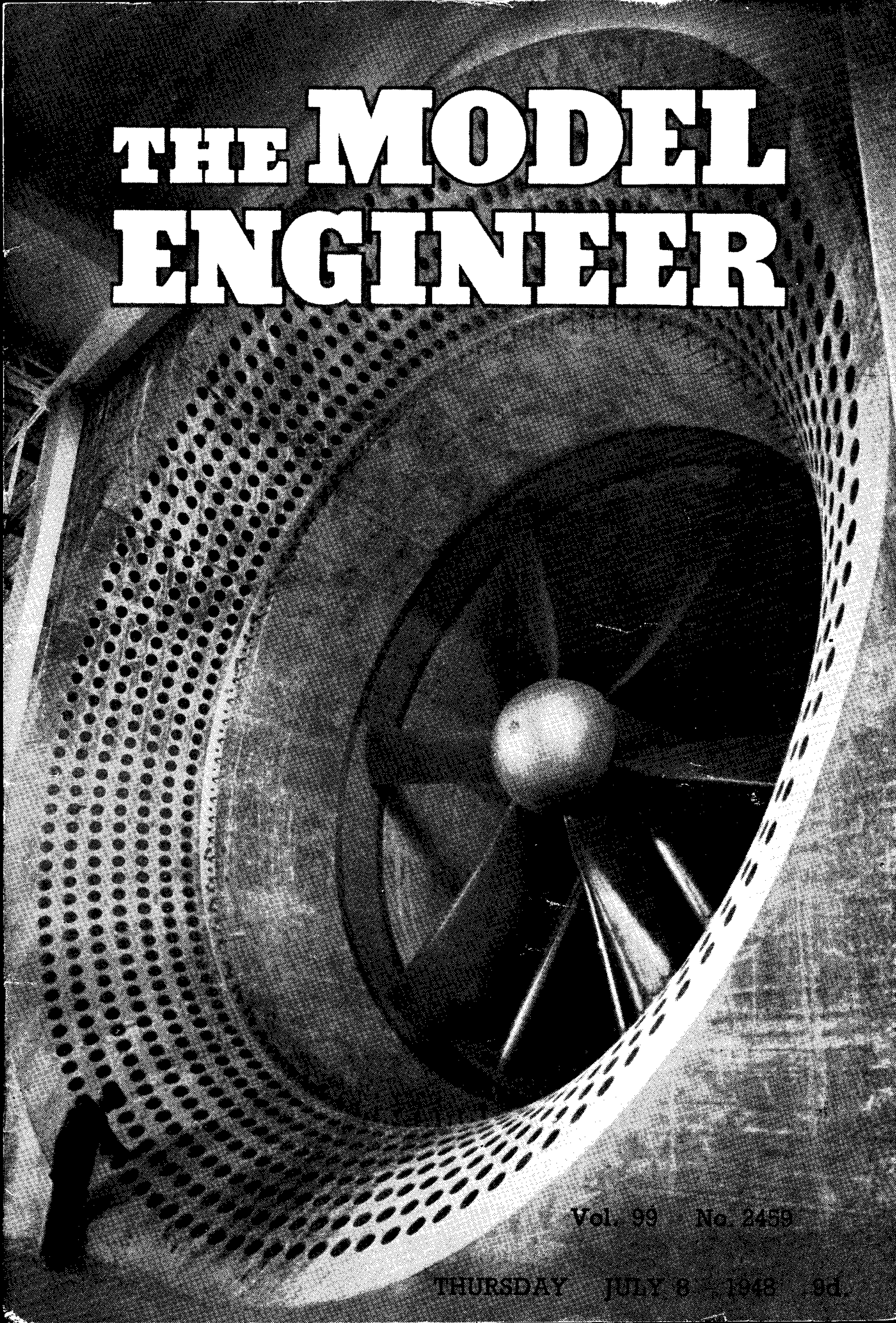
THE MODEL ENGINEER



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The MODEL ENGINEER

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8TH JULY 1948 VOL. 99 NO. 2459

SMOKE RINGS

Not Quite Too Late

● READERS ARE reminded that Monday next week, July 12th, is the closing date for the receipt of competition entries for THE MODEL ENGINEER Exhibition. If you are intending to participate in this competition, there is still just time, provided you post your application this weekend.—P.D.

Exhibition Stewards Wanted

● FROM AUGUST 17th to 29th, the services of exhibition stewards will be required at THE MODEL ENGINEER Exhibition for duties such as assisting with the unpacking of models and arranging them on the stands; also, for supervising and helping the public during the opening hours of the exhibition, and again at the close to assist with the return of models to their owners. A generous allowance will be made for expenses and fares, and to those interested in models the work is of a most enjoyable nature among kindred spirits It may be that you could serve at certain times or for only a part of this period. This would not prevent you helping on the days when you are free. If you are a member of a club and would like to assist in this way, please write at once to the Exhbition Manager, stating the days and times when you could be available.—P.D.

Our Cover Picture

● THE PHOTOGRAPH we reproduce this week is taken from a somewhat unusual angle, and shows one of the wind tunnels used in this country for experimental development and testing of aircraft components and models. When we read the astronomical figures of the cost of the larger types of aircraft, we are apt to forget that in addition to the cost of materials and the thousands of man-hours which go into production, the cost of experimental development, including such items as wind tunnels, must in the long run be taken into account, and our cover picture will no doubt convey to the lay mind that this may well be no small item.—P.D.

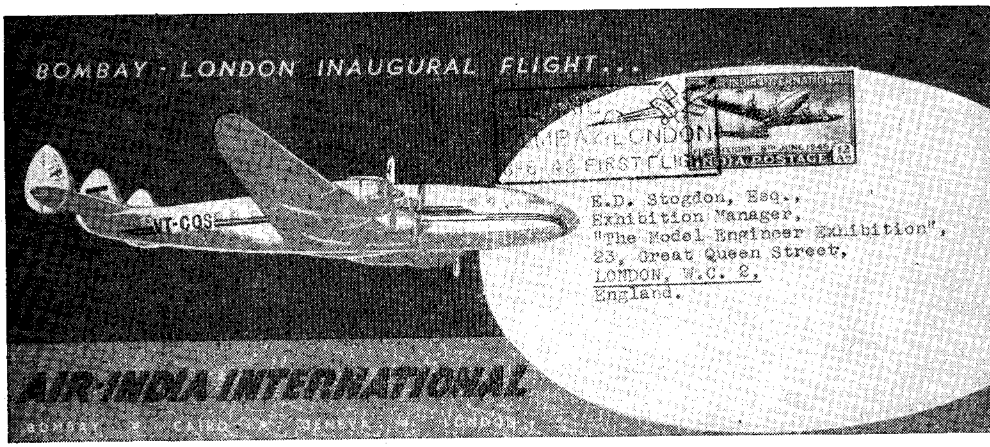
The Crash of "Nickie 7"

● MANY MODEL power boat enthusiasts were very disappointed at the non-appearance of Monsieur Suzor at the International Regatta on June 6th, which was due to a very unfortunate accident with his boat *Nickie 7*. I have received some exact details of this occurrence from Mr. R. O. Porter, a well-known enthusiast, and a friend of Monsieur Suzor, who was present when this happened. He informs me that on Saturday, May 29th, this boat ran fifteen circuits at an estimated speed of 90 kilometres per hour, or 56.11 miles per hour. The engine started

extremely easily with no delay or preparation beyond filling up with ordinary petrol. The line used was two strands of 23-gauge piano wire. After the boat had made a very fine run of fifteen laps, and just when the petrol was becoming exhausted, both strands of the line parted where linked to the harness; the boat struck the stone embankment and the engine was torn out of the hull, hit the embankment, bounced about 10 ft. into the air and fell back into the water. Mr. Porter suggests this must have been quite the most fantastic accident that had happened in the history of model speed boat running. The break in the line was exactly where the wire was wrapped round the standing portion, which indicates that the least kink in this type of wire is dangerous. Some details of *Nickie 7* together with a photograph were given in the January issue of *Model Ships & Power Boats*. The hull is 1 metre long, very light and strong in construction with two pontoons of balsa wood, being similar in this respect to the hull of *Mslle. Scylla II*, which ran so successfully at last year's Grand Regatta. The engine is of 30-c.c. capacity which is a breakaway from Monsieur Suzor's usual practice, being a 4-stroke o.h.v. engine, and is now fitted with an M.I. magneto driven from the cam shaft. The weight of the complete boat is 3.6 kilograms. Monsieur Suzor fitted a safety device to the engine to prevent entry of water in the engine in the case of immersion, and it is interesting to note that this worked successfully in the case of the crash, the damage being entirely due to collision. All model power boat enthusiasts will, I feel sure, join with me in expressing regret at this misfortune, and hoping that Monsieur Suzor will be able to repair the boat and make an appearance at this year's Grand Regatta.—E.T.W.

The Bombay Cup

● I AM asked by our Exhibition Manager to make it known to readers that the reason why the cup donated by the Bombay Society of Model Engineers is not being presented this year, is entirely due to existing Exchange Control Regulations. Mr. Polson, the chairman of the Bombay Society, asks us to make it quite clear that the donation of this cup last year was not just a passing thought, and as soon as the regulations are relaxed it is his intention that the annual donation of this cup shall be continued. As a matter of interest to our readers, we reproduce here a picture of the envelope containing Mr. Polson's letter, which was carried on the "Constellation" aircraft which made the inaugural flight of the Bombay-London Air Service, for which special envelopes and special stamps were printed.—P.D.



It Pays to Advertise

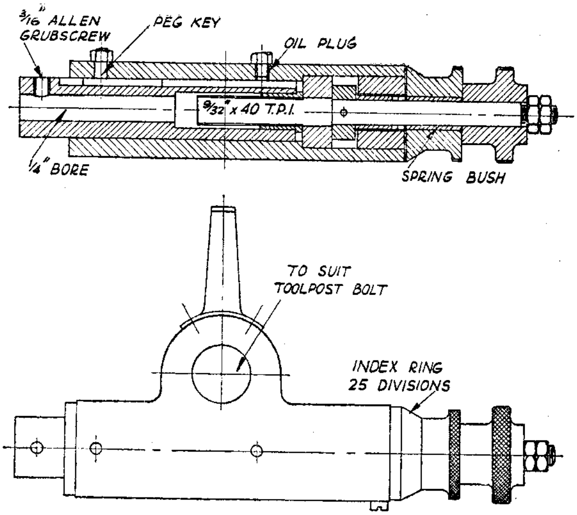
● THE FAVERSHAM and District Model and Experimental Engineering Society has sent me a photograph of an attractive window display in one of the local shops, showing some of the models, finished and unfinished, built by members of the Society. This display, they tell me, attracted a great deal of attention, and, as a result, four new members were enrolled at the next general meeting. This is an idea which might well be tried by other clubs wishing to increase their membership and advertise their existence to the local population. A card occupying a prominent position in the window listing the advantages of membership and extending an invitation to newcomers should, of course, occupy a central position.—P.D.

Society of Inventors' Exhibition

● THE SECOND annual exhibition of the Society of Inventors has been arranged to take place from October 25th to 30th this year and will be held at the Chamber of Commerce Building, Birmingham. This exhibition, which is open to the public, provides a medium for enabling inventors to bring their creations to the notice of manufacturers and others who may be interested from the commercial viewpoint. Entries for the exhibition are accepted from non-members of the society, and anyone wishing to enter an exhibit should write to the Secretary, Mr. B. Thornton Clark, 244, Stoney Lane, Yardley, Birmingham, 25, for full particulars. One of the conditions of entry, I understand, is that all exhibits must be either patented, protected or of registered design.—P.D.

An Accessory for Screwcutting in the Lathe

by K. N. Harris



Special toolholder for screwcutting

THE method of cutting threads with a tool, cutting on one edge only, and fed in along a line parallel to the other face of the thread is perhaps not so well known as its undoubted advantages warrant.

By its use the actual tool may have top rake and so be made to cut more cleanly and freely in " sticky " materials, and there is less strain on the tool, too.

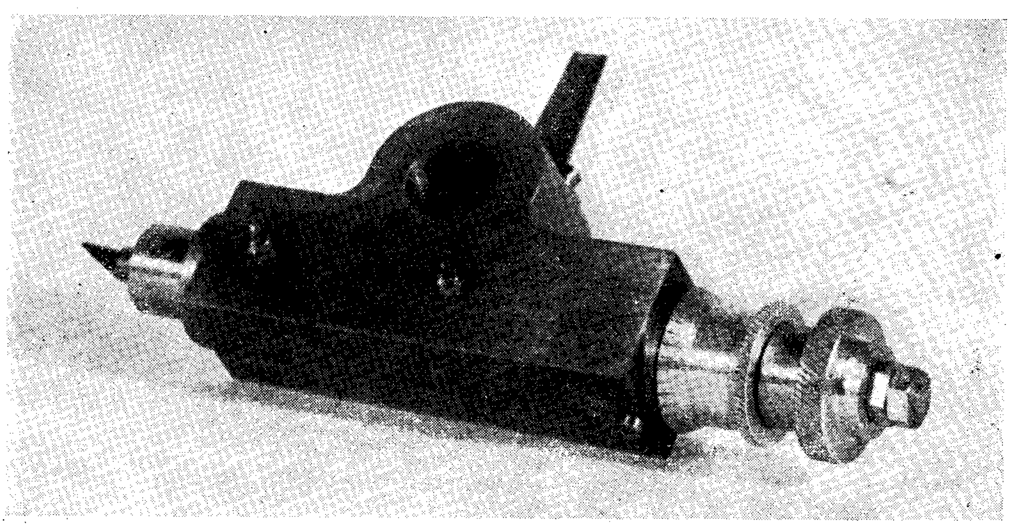
Normally, the adoption of this method entails the setting of the top slide to an angle with the cross-slide equal to half the included angle of the thread.

With some of the modern cheap lathes, this either cannot be done or is very awkward of accomplishment ; further, if a top slide is accurately set for parallel turning, it is a pity to disturb it. And here, just a word aside in this connection to members of clubs that possess a communal workshop : if you have occasion to set the top slide for taper turning, re-set it for parallel turning before you leave the lathe.

Where the taper is a narrow-angle one, the small set-over involved is not always immediately apparent, and the next man to use the lathe may fail to notice it and run into trouble ; that can happen to experienced mechanics !

The device illustrated in the drawings and photographs was designed and made to enable the advantages of the system to be obtained, and to minimise its setting-up drawbacks. It is not new in principle, nor do I make any claims to originality.

Similar devices have been described in the past, but quite a long time ago and differing in detail



The screwcutting device

from this one. The chief aims I had in mind were constructional simplicity, delicacy of feed control and robustness.

The body was made from a piece of scrap B.D.M.S. 1 in. thick and was cut to shape by the old-fashioned method of drilling, hacksawing and filing to contour.

Here it might be well to say that the lug is not an essential part of the job and the body may be made as a simple square section with quite an appreciable reduction in the amount of work involved; the particular device illustrated was designed specifically to fit my 90-mm. Boley S.C. lathe and to be held direct on the toolpost.

The heavy milling file is not so well known to amateurs as it deserves to be; it is a tremendous metal-shifter and, to all intents and purposes, "unpinnable"; I always keep a couple in regular use, one for brass and non-ferrous generally, the other for steel (and cast iron).

As they wear, and this takes a long time, anyhow, the "brass" is demoted to "steel" and the "steel" to "copper and lead."

Before finishing the outside of the body it was set up in the four-jaw chuck and bored and faced. The moving plunger-cum-tool carrier was machined from silver-steel, the gunmetal nut being a press fit. The tool, of $\frac{1}{4}$-in. round section, is locked by a $\frac{3}{16}$-in. Allen grubscrew in the plunger nose.

The keyway was cut with a 5/32-in. end-mill in my Wolf-Jahn milling machine.

The peg key was made up in two pieces, the key proper and the retaining peg, which is pressed and riveted into the key, and threaded at its upper end to take the retaining nut. Note that the back of the key should be contoured to be a snug fit in the bore of the body: the key, of course, should be a close fit in the keyway sideways and just clear depthways. The oil-hole in the body feeds directly into the keyway, which in turn distributes the oil to the body, screw and nut; it is closed, to exclude dirt, by a $\frac{1}{8}$-in. cheese-head screw.

The feedscrew is made from silver-steel turned 9/32 in. on the body and reduced successively to $\frac{1}{4}$ in. and $\frac{3}{16}$ in. for the operating knob and retaining lock-nuts. The screw is threaded 40 t.p.i. 9/32 in. diameter and the lock-nuts 40 t.p.i. $\frac{3}{16}$ in. diameter.

The locating collar, also of steel, was temporarily fixed by a small grub-screw and when adjusted to correct location, finally fixed by a taper pin: it works between G.M. faces, a washer at the front and a special bush at the back.

The Special Bush

This item is in two parts, an outer bush plain outside and tapped $\frac{1}{2}$ in. 40 t.p.i. inside and an inner bush bored 9/32 in. and threaded $\frac{1}{2}$ in. 40 t.p.i. outside, which fits inside the outer bush; this inner bush is slotted at the back end to allow a special screwdriver to be used to adjust it.

The outer bush is a good push-fit in the recess in the body and is located and held in place by a $\frac{1}{8}$-in. screw, which passes right through it, and when tightened serves to lock the screwed bush also.

The object of the latter, of course, is to take up end-play in the operating screw.

The operating knob is a plain turning and boring job and is made from brass with a knurled thumb-ring; it carries the indexed ring, made from duralumin.

This ring is friction-mounted by the very simple method of inserting between it and the barrel of the operating knob, a brass spring bush split like a collet, three ways from each end; this is quite simple and most effective.

The Index Ring

This item is divided into 25, each fifth mark being rather longer than the intervening four. Each division represents a *direct* advance of the barrel of 1/1,000 in., but, of course, the actual cut is less, owing to the angle of advance being less than 90° to the work. In passing, this elementary trigonometrical function can be made of practical use for very accurate work where a lathe is itself sufficiently accurate in the first place to warrant it. By setting over the top slide and using it to provide the increase in cut (of course, this can only be done when using the main sliding feed to provide the traverse) an advance of, say, $\frac{1}{1000}$ in. of the top slide carriage becomes much less, dependent on the angle of setting of course, in tool advance towards the lathe axis, i.e. cut. For instance, if the top slide is set at 30° to the lathe axis, the ratio is exactly 2 of advance to 1 of cut. However, if you are going to take advantage of this, your lathe must be of a high order of accuracy and rigidity, your slides and mandrel perfectly adjusted and your cutting tool, sharp and correctly made.

Reverting to the index, this was graduated on a "Quickset" gear-cutting device, quite one of the best things of its type available. This was set up on the vertical slide, itself mounted on the cross-slide of my 90-mm. Boley lathe. The face of the vertical slide was set at an angle to the lathe axis equal to the angle of bevel on the ring to be indexed.

The dividing-head was set with its axis at exactly centre height. The index ring was mounted on a mandrel; the holding device on the "Quickset" head being a collet, one end was turned to fit, $\frac{3}{8}$ in. diameter, and the other centred for the support of the back centre. A special centre was ground to a fine point and mounted in a collet in the mandrel nose to act as a cutter.

The worm-wheel on the dividing head has 90 teeth with a single-start worm. There are three divided plates, one of which has a 30-hole ring, and this ring was the one used for the job. The calculation (and this is one of those jobs where you just *have* to make a calculation) is a perfectly simple one.

You require 25 divisions; you have 90 teeth in the worm-wheel and 30 holes in the division plate, hence a movement of 1 hole $= \frac{1}{2700}$ of a turn on the worm-wheel spindle; we want 1/25th, therefore, we need $\frac{2700}{25}$ holes per division $= 108 = 3$ turns plus 18 holes on the worm spindle for each division.

The index pointers were set to embrace 19 holes, *not* 18. This is a small but important point, as it is easily overlooked; from 1 to 18

would give you only 17 *holes advance*

Traverse was effected by the cross-slide and feed by the main carriage, and, needless to say, care had to be exercised to keep the latter very light.

It would, of course, have been quite feasible to arrange the index to read in $\frac{1}{1000}$ in. increase in *cut* per division, but only for *one* angular setting. As the device is likely to be used indiscriminately for Whitworth, B.A., Metric or Acme threads, all of which have different angles, there would be no advantage in so doing.

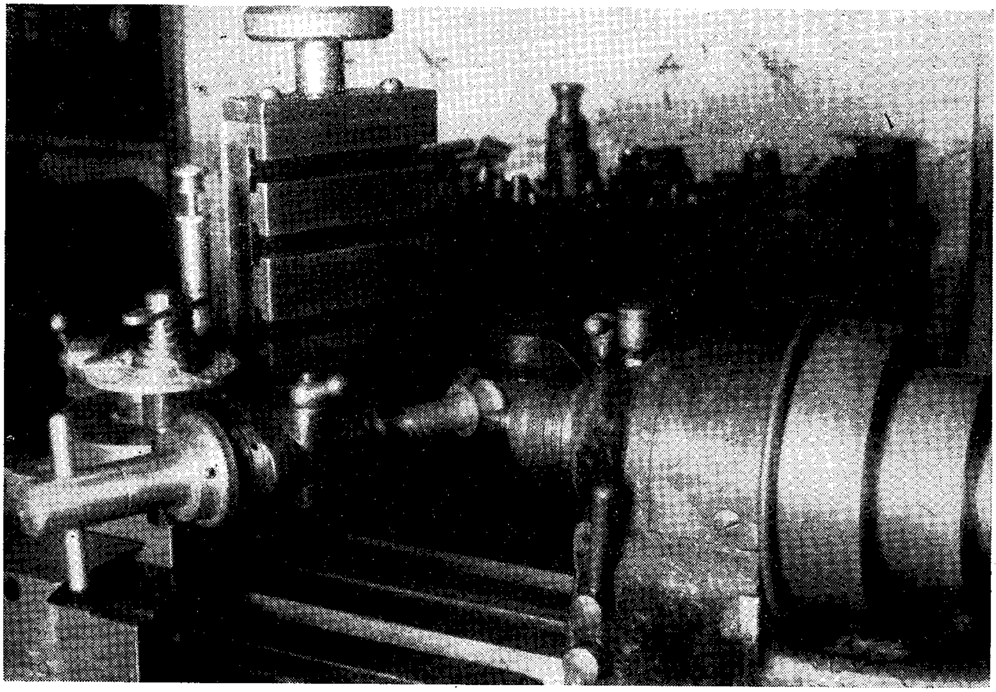
The long pointer serves as an indicator for angular setting. The top slide carriage of the Boley has a separate steel plate to carry the toolpost, an excellent idea which minimises liability to distort the carriage when tightening up tools, and a separate plate has been made for this device. On it are set out marks which coincide with angular settings of the axis of the device of 14° (Acme), 23¾° (B.A.), 27½° (Whitworth) and 30° (Metric and American).

Toolbits

The cutting edge of these must be exactly at centre height and it must be at an angle to the axis equal to the *included* angle of the thread to be cut (the bit shown in the photograph is of 28° angle for Acme threads). This, of course, entails separate bits for each type of thread, and it is well to adopt some simple means of identifying them, as the difference between 55° and 60° is not readily apparent to the eye of the normal individual. Besides being set exactly at centre height, the cutting edge should be horizontal.

For the cheaper kind of lathe with a single slide (no fully compound rest), it is a very great help indeed, and it is of value for other work than screwcutting, e.g. taper turning, and it is really worth making on this basis alone.

One word of caution—once set-up, the top-slide must not be moved; in fact, it is a good thing to tighten it up temporarily to prevent accidental movement.



Set-up for dividing index thimble

With regard to the cross-slide, the index reading should be checked on commencing the job, the cross-slide may be used for withdrawing the tool at the end of the traverse whilst the saddle is returned; before each succeeding cut the feed is re-set to the original index reading, *all cut is applied solely by the special tool-holder.*

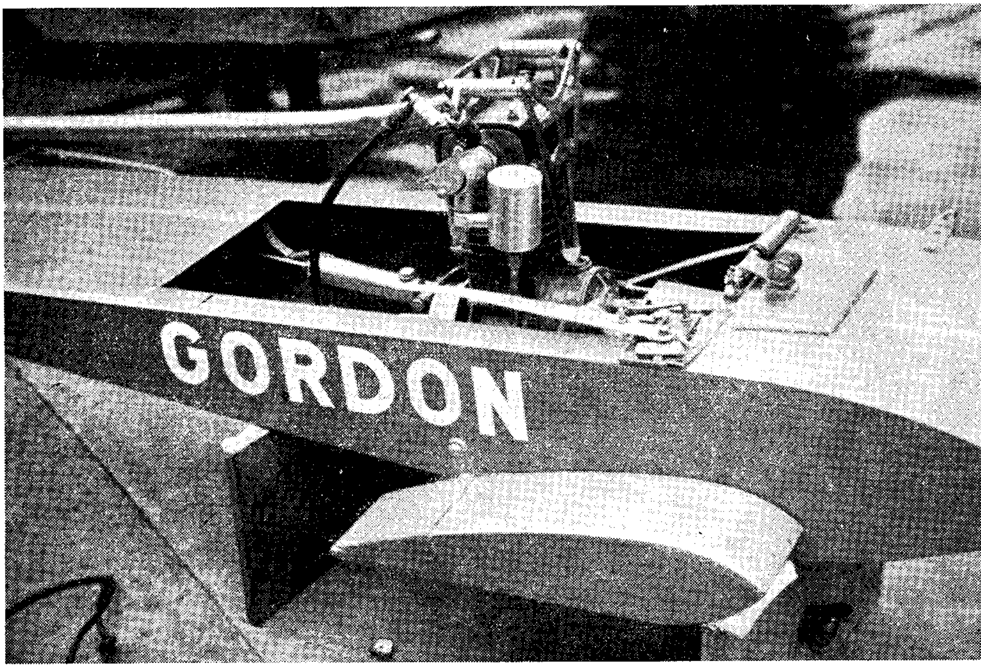
Where an odd thread is being cut and a reversing drive is available, there is everything to be said for running the tool back with the clasp-nut in gear, which saves all possibility of error, a thing to which even the most gifted amongst us are occasionally prone! There is something to be said for the solid fixed lead-screw-nut in this connection, often found on the cheapest type of S.C. lathe.

Mr. Latta comments, in his article on Fun and Games with your Screwcutting Lathe, in the February 5th, 1948, issue, most favourably on the half-thread angle feed method and on the difficulties of implementing this on many amateurs' lathes; the device described is, at least, one answer, and a satisfactory and cheap one at that.

THE INTERNATIONAL REGATTA

THE Seventeenth Annual International Regatta of the Model Power Boat Association was held on Sunday, June 6th, at the usual venue, Victoria Park, London, E.

The " International " atmosphere was lacking to some extent, due to the absence of Monsieur Suzor of Paris, and Mr. Rankine of Ayr. Monsieur Suzor had intended to come, but an accident had occurred to his boat during the previous week, while running at very high speed, the damage being such that it was impossible to make repairs in time.



Both the hull and the engine of Mr. Clark's " Gordon " are distinctive in design, and exhibit a high standard of workmanship and finish

The programme started with the smallest type of boats (" C " class), but these were hampered by quantities of floating weed, which seemed to be very prevalent, most boats suffering from propeller fouling.

The first event was a 500 yd. race for the Wico-Pacy Cup. Last year's winner, Mr. A. Martin (Southampton), with *Tornado III* was first on the line, but due to weed did not manage to complete the course. Mr. Heath (Victoria), with *Derive* came next, but suffered similarly ; in fact, only one boat returned a time on the first round. On their second attempts, both Messrs. Heath and Martin were again unable to complete, and it began to look as if it would be difficult to fill the first three places, but Mr. J. Cruickshank (Victoria), with a brand-new surface-propelled boat *Defiant III*, managed to complete at a very creditable speed, winning the event, the final placings being as follows :

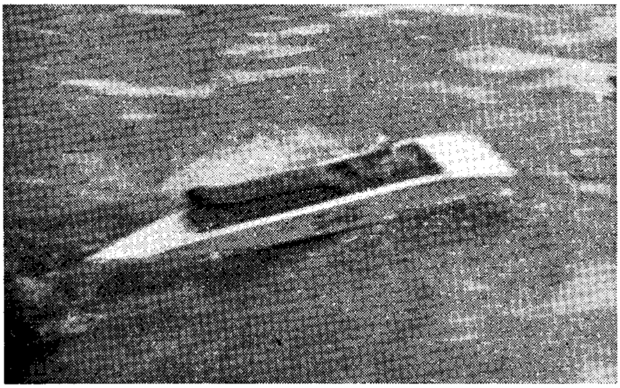
1st.—Mr. J. Cruickshank (Victoria), *Defiant II*, 41.2 sec., 24.83 m.p.h.
2nd.—Mr. A. Stone (S. London), *Sizzle*, 43.2 sec., 23.67 m.p.h.
3rd.—Mr. Oaks (Victoria), 53.1 sec., 19.14 m.p.h.

The " B " class boats were next on the list in a 500 yd. race for the Miniature Speed Championship Cup. In view of the fine performance of Mr. Jutton's *Vesta II* at the Victoria regatta recently, some fireworks were expected, during this event, and the spectators were not disappointed. A newcomer to Victoria Park, Mr. Mitchell (Runcorn), with a fine 15 c.c. four-stroke engined boat, also put up a fine performance. Mr. A. Martin (Southampton), with *Tornado IV* was off form, but due to lack of suitable water it had not been possible to do any running since the Grand Regatta of last year, and this no doubt accounted for the trouble. On the other boats in this race, none approached the speed of the first two place winners, but here again the debris, which apparently was attracted to propellers like tacks to a magnet, was responsible.

The result of this event was thus :

1st.—Mr. Jutton (Guildford), *Vesta II*, 28 sec., 36.51 m.p.h.
2nd.—Mr. Mitchell (Runcorn), *Beta*, 32.98 sec., 31.01 m.p.h.
3rd.—Mr. Duffield, 44.32 sec., 23.09 m.p.h.

The International Race, for Class " A " boats, over a course of 500 yd., followed, and some good runs were seen although not up to best speed.



Mr. Martin's class C flash-steamer "Tornado III" winner of last year's race, was unfortunate on this occasion, and failed to complete the course

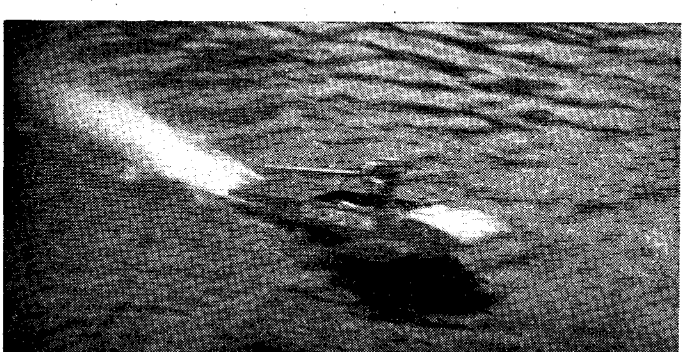
Mr. Cockman, the holder of this trophy, was not competing, due to his boat having been damaged the previous week during trial runs, but Mr. Clark, who also sustained severe damage on the same occasion through line breakage, had managed to repair *Gordon* by dint of furious efforts, and reaped his reward by winning this race. *Gordon*, which has a surface propeller, is most spectacular in action, and obviously capable of very high speed.

The first boat away was *Faro*, belonging to Mr. Williams (Bournville), which put up a fine run. Mr. Clark was next, but could not complete. The weed which was still about, affected even these powerful boats to some extent, and caused several competitors' boats to stop on the course, among these being those of Mr. Waterton (Altrincham), who had an interesting two-stroke engined boat, Mr. Miles (Maldon), and Mr. Lines (Orpington), with *Blitz III*. On the second time round, Mr. Clark (Victoria), with *Gordon*, put up the best performance, and several others managed to improve their times. Mr. Meageen (Altrincham), had altered the engine of *Samuel* for this regatta, but had no luck, *Samuel* proving very difficult to start. The result of this race :

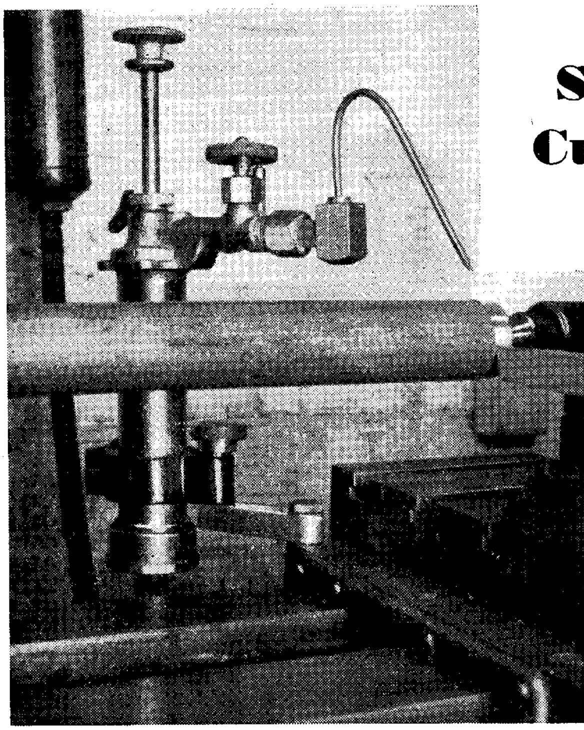
1st.—Mr. E. Clark (Victoria), *Gordon*, 27.4 sec. 37.32 m.p.h.
2nd.—Mr. Williams (Bournville), *Faro*, 28.57 sec. 35.78 m.p.h.
3rd.—Mr. Parris (S. London) *Wasp*, 32.5 sec. 31.47 m.p.h.

Demonstration runs by the place winners of the three races followed, and some good, though not outstanding, runs were made. Towards the end of these runs, the weather, which had been threatening rain all day, finally broke, and the prize-giving had to be made within the somewhat confined precints of the boathouse, with Mr. Vanner, the president of the M.P.B.A. officiating.

(Above) Mr. Cruickshank gives the hull of "Defiant III" a final polish before going in to win the Wico-Pacy Cup



(Left) An impression of "Gordon" running at over 40 m.p.h. in the International Race



The pump in use on an "M.L.7"

A Semi-Automatic Cutting Oil Pump

by A. R. Turpin

THERE is no doubt that the most efficient method of supplying a copious stream of cutting oil to the tool when turning, is by means of a mechanical pump, but this method is not to be recommended to most amateur engineers because of the confined space in which they have to work, with the result that most of the workshop is spattered with lubricant, especially when working at a high cutting speed. The more usual amateur methods are to supply the cutting oil by means of a drip can or by a brush. If the former method is used the flow, being controlled by a needle-valve and gravity, it apt to be spasmodic ; the tendency being to either go or stop. Application of the fluid by means of a brush is quite efficient, but tends to become irksome if long shafts have to be turned by means of the automatic feed.

When the writer noticed that a dealer* in Government "surplus" stores was offering, for a few shillings, a semi-automatic plunger pump complete with needle control valve, he decided that here was an ideal method of supplying small quantities of lubricant to a lathe tool, and having purchased one, it was soon set up to operate, as shown in the photograph.

The pump is similar to those fitted to motor-cycles, twenty-five years ago, with instructions to depress the plunger and adjust the needle-valve to give thirty drops per minute, and the rider being reminded by the nasty hot smell coming from the engine that it was time to depress the plunger again.

The actual pump is shown in the drawing, together with the extra bits and pieces necessary to convert it to its new use.

These consist of *A*, a collar with two lugs, which can be made from a casting, or machined from the solid. The centre is bored out to fit the plunger pump-barrel, and sawn through the small lug which is tapped and drilled 2-B.A., so that the collar may be clamped to the barrel by a knurl-headed finger-screw ; this will allow the pump to be adjusted for height. The other lug is drilled $\frac{1}{4}$ in. clear so that it may be fixed by means of $\frac{1}{4}$ in. B.S.F. finger-screw to the link *B*. This link, which may be about 2 in. long, has a $\frac{1}{4}$ in. B.S.F. tapped hole at one end and a $\frac{1}{4}$ in. clear hole at the other, the latter hole being used to bolt this link to the corner of the carriage, as shown in the photograph, a hole having first been drilled and tapped in it for the purpose. Alternatively, it may be bolted to the cross-slide, a position preferable when surfacing. The pump may be swivelled about this link to obtain a further adjustment of position.

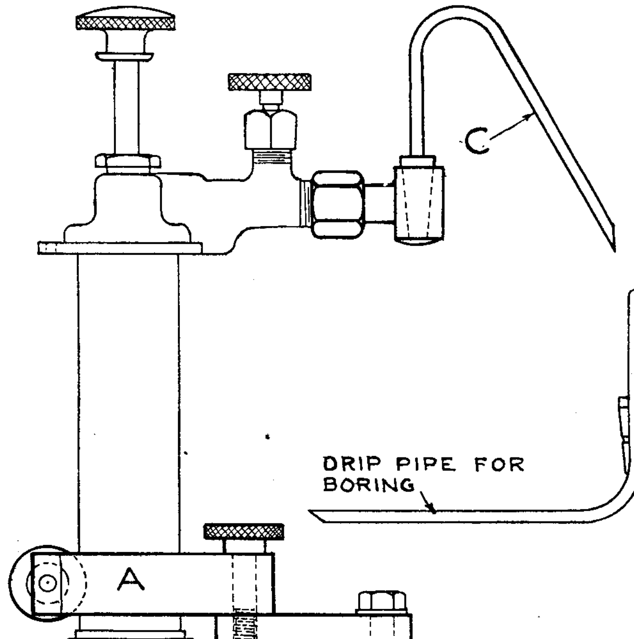
Before the collar *A* can be slipped over the barrel, the threaded end-piece must be unsweated, not forgetting to remove the plunger and return spring when this is done.

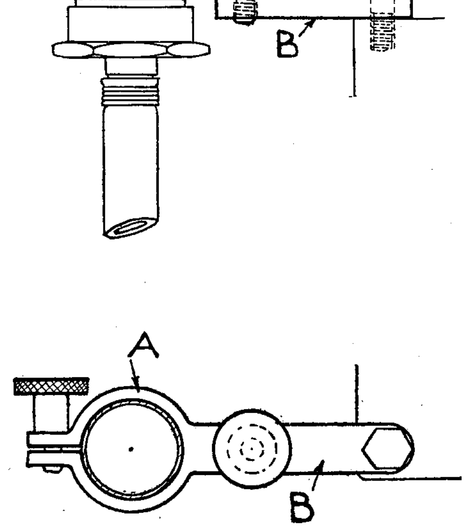
To attach the drip pipe *C* to the pump, cut a $\frac{3}{4}$ in. length of $\frac{1}{2}$ in. sq. brass rod, chuck it in the four-jaw and drill a $\frac{3}{16}$-in. hole right through its length, then taper reamer this hole to an inclusive angle of 10 deg. A suitable reamer may easily be made by taper-turning a piece of silver-steel to this angle and then filing it exactly in half, hardening and tempering to a medium straw colour. It will help to keep the hole true if a short length is turned on the entry end $\frac{3}{16}$ in. diameter, and left unfiled.

Having reamered the hole, drill a second hole 3/32 in. diameter half-way down and in the centre of one side of the square rod, so that the drill enters the taper hole. Open this hole out to $\frac{3}{8}$ in. for a depth of $\frac{1}{16}$ in., push the end of a $\frac{1}{4}$ in. nipple into this hole and silver-solder in position complete with nut. (See detail drawing.)

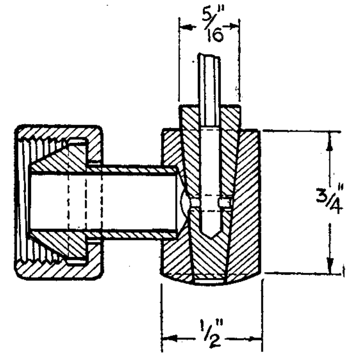
A piece of $\frac{3}{4}$-in. diameter brass rod is now

* Instrument Co., 244, Harrow Road, London, W.2.





Elevation and plan, showing conversion of plunger pump



Detail, in section, of attachment for drip pipe

chucked in the three-jaw and taper-turned to fit the hole; this is best done at the same time as the reamer. Try the rod in the square brass-piece, and by pushing a scriber through the nipple, mark the former with a scratch to indicate the position of the hole, and using this mark as a guide turn a groove right round the taper about $\frac{1}{16}$-in. wide and half as deep.

Part off the taper portion of the rod, and leaving half an inch of plain rod, reverse and chuck by this portion. Now drill a 3/32-in. hole down the centre to just below the turned groove, unchuck and clamp in the machine-vice and drill a $\frac{1}{16}$-in. hole right through the centre of the groove. Now make an exact duplicate of this plug. The actual drip pipes are made from 3/32-in. brass tube, as used by model aircraft constructors for propeller shaft bushings. Two suitable lengths of this are soldered to the plugs, having been previously annealed, and then bent as shown, one being used for plain turning and the other when boring.

These drip pipes are held in position only by the taper so that they may be easily swivelled or changed in a few seconds.

The pump is connected to a reservoir, fixed to a support behind the lathe by a piece of rubber tube. A suitable vessel can be easily made from a tin with a cover, in the bottom of which is screwed or soldered a combined filter and tap, as used on motor-cycle petrol tanks.

Before use, the pump should be very carefully cleaned and the cutting-oil always filtered; otherwise it will be found difficult to obtain a steady drip. Normally, it should be possible to adjust the needle-valve to give a drip from ten drops a minute to a steady stream. At about 60 drops per minute the lubricant will run for about six minutes for one stroke of the pump plunger.

It is not advisable to use plain soda water in this pump because, if it is not used for some time, crystals form in the valve and drip pipe, and it takes a little while before an even flow can be obtained. It is unfortunate for the model-maker that more dealers do not stock cutting-oil in small quantities of, say, half-a-gallon or a quart, instead of the usual five-gallon cans.

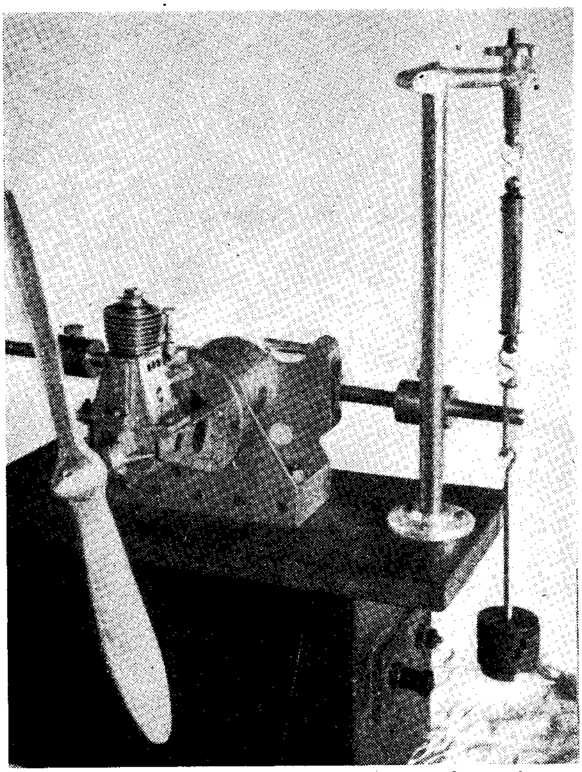
It is also surprising how few garages seem to use a cutting-oil when turning.

PETROL ENGINE TOPICS

*Testing Small I.C. Engines

by Edgar T. Westbury

DETAILS of the torque reaction balance referred to in the last instalment are given in Fig. 2 and its construction is so straightforward that it should not require detailed explanation. For testing an engine on this balance, the engine is first attached, and the torque arm, if fitted with a locking device, is released to allow the assembly to be statically balanced by adjusting the counterweights on either side. The centre of gravity of the engine assembly should be slightly below the level of the torque shaft centre, in order to produce stable equilibrium. If, however, it is above the shaft centre, the system will be unstable, rendering the adjustment, under running conditions, extremely critical. Improvement of stability may be obtained by adding small weights to the lower part of the faceplate or engine bracket, but this should not be overdone to such an extent as to render adjustment insensitive or sluggish. The best conditions are arrived at when the torque arm, after adjustment of static balance, tends very slightly to return to centre position after being pushed up or down within the limits set by the stops.



The writer's torque reaction balance, suitable for engines up to 10 c.c., equipped with airscrew or fan brake

Exact alignment of the engine shaft with the torque shaft centre is not essential to correct torque measurement, and torque reaction balances have been produced in which the entire power unit is mounted on a table resting on knife edges, so that the torque balance centre is well below the power shaft. This arrangement, however, introduces complications in stabilising, and is also open to certain errors which are best avoided when exact measurement of light torque forces are required.

It is desirable, in the case of the small engines under consideration, to mount the entire unit on the torque stand, including fuel and oil tanks, ignition equipment, etc. This avoids the possibility of errors being introduced by stiffness or spring in pipes or cables used to connect up any external accessories.

The use of an external ignition battery, however, is permissible, provided that its connecting leads are really flexible, and can be proved to have no perceptible effect on the sensitivity of balance. It may be remarked that the complication of connecting up a steam engine to an external boiler, or a water-cooled i.c. engine to its radiator or cooling tank renders engines of this type difficult to test by torque reaction methods.

Having observed all the preliminary precautions, the torque arm should now be locked, if possible, and the engine started. No attempt should be made to take any readings until it is properly warmed up, and all necessary adjustments have been made so that it is running perfectly smoothly and steadily at its optimum speed. The torque arm can then be released, and it will be found that the system has now become unbalanced, forcing the arm against the limit stop in a direction opposite to that of engine rotation. By loading the arm to restore equilibrium, the exact force of torque reaction can be ascertained, as it must necessarily be equal to the weight required to restore the original condition of static balance.

Although this force may be measured at either end of the torque arm, it will generally be most

*Continued from page 659, Vol. 98, "M.E.," June 24, 1948.

convenient to load the arm by gravity at the end which has moved upwards, that is to say, at the right-hand end for engines rotating clockwise, or the left-hand end for anti-clockwise rotation. In cases where a combination of weight hanger and spring balance is used, the latter should have a very light reading, and act in opposition to the weight which is the main load; the actual force thereby applied will then be equal to the weight on the hanger, minus the spring balance reading. This method improves the stability of the system, with no loss of sensitivity, and minor adjustment of loading may be obtained by raising or lowering the point of suspension of spring balance, means for which are provided on the suspension arm of the balance illustrated.

To obtain a reliable torque test, steady conditions are most essential, and the duration of the test should be sufficiently long to ensure that the speed and torque are truly representative of what the engine can do under working conditions. On no account should any attempt be made to test an engine while its speed shows any perceptible variation, or while it is misfiring, 4-stroking or "sending out messages in Morse code." The load characteristics of an airscrew or fan brake tend to promote steadiness in loading, and it is impossible to keep the torque arm balanced under fluctuating conditions. The use of a damping device such as a vane immersed in oil has often been recommended as a means of obtaining steady torque readings on very rough-running engines, but my experience suggests that, although this measure may be beneficial in certain cases, there is something radically wrong with an engine which cannot be properly tested without it.

Any reliable standard weights and spring balance may be used with the torque reaction balance or any other form of dynamometer. I found that the most convenient weights are those produced for laboratory use by firms such as Cussons, Baird & Tatlock, or Becker, as they can be obtained in decimals of a pound, from 1/1,000th to 1/10th, which simplifies computation of horse-power on a decimal basis. The spring balance should be similarly calibrated, but it

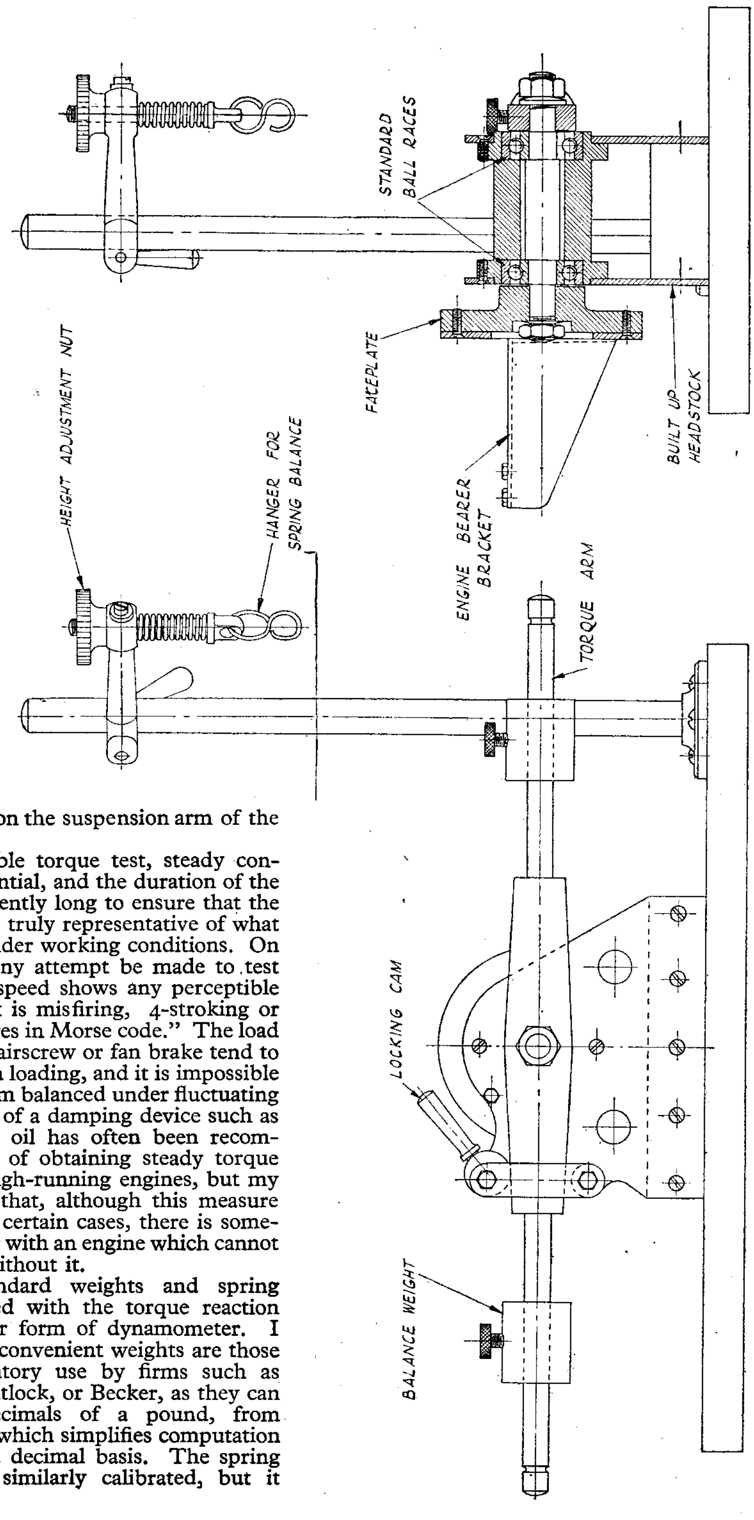


Fig. 2. End elevation, and section on shaft centre, of torque reaction balance

may be found rather difficult at present to obtain one of suitable type, and it may be necessary to re-calibrate, or even construct a special balance for the purpose. This is not a difficult matter, and I suggest that a circular dial balance, reading up to about 0.25 lb. would be most convenient for testing engines of the sizes most readers are likely to encounter.

Assuming that means of accurate speed measurement are available, the measurement of horse-power with this or any other form of dynamometer entails only the observance of the speed factor in conjuction with that of torque in terms of foot/pounds. In the torque balance illustrated in Fig. 2, a fixed length of 6.3 in. for the torque arm is recommended, in order to simplify torque calculations. This produces a "constant" of 10,000, or in other words, the formula for h.p. calculation is $\frac{W \times N}{10{,}000}$, W being the weight necessary to balance torque reaction, and N, the number of revolutions per minute. This arrangement of the torque arm, using the same dimensions and the same constant may be used for any type of torque measuring device. By way of examples of h.p. calculations, an engine running at 5,600 r.p.m. and producing a force of 0.375 lb. at the torque arm, will develop $\frac{5{,}600 \times 0.375}{10{,}000} = 0.21$ h.p. Again, an engine running at 7,500 r.p.m. and producing a torque reaction of 0.25 lb. will develop $\frac{7{,}500 \times 0.25}{10{,}000} =$ 0.1875 h.p.

Many readers will be capable of working calculations of this nature by mental arithmetic. If, however, torque readings are taken by means of a sliding weight on the torque arm, so that balance is obtained by varying the leverage, the calculations are more involved, and are best dealt with by the use of a slide rule. It is not considered necessary to explain these points in detail, as they are dealt with in any standard text-book on principles of mechanics. Here again, they apply to any form of torque measuring device, no matter what methods of load application or power absorption are employed.

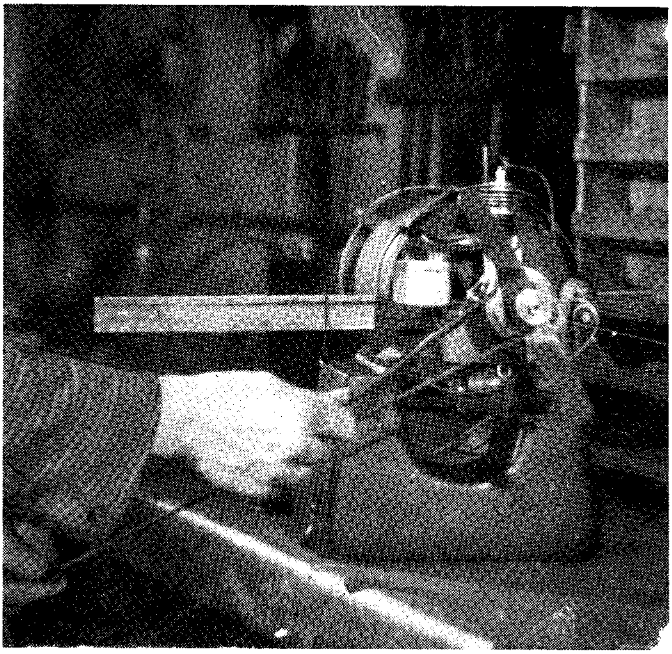
It is appropriate at this stage to consider how the essential requirements of accurate speed measurement are best carried out. There are many kinds of devices available for indicating speed, and the suitability of any particular form of instrument will depend on individual circumstances. The fitting and coupling-up of a speed indicator or tachometer on the simpler types of engines and test stands may present problems, and the power absorbed in driving the instrument may produce errors in the readings.

Hand tachometers which can be applied when the engine is running are extremely convenient, and the power they absorb is accounted for in the reading of the torque balance, but they often make balancing more difficult, and slip may take place in the drive, which is usually by means of a male or female friction tip.

Accurate speed indicating instruments are necessarily expensive, but there are at present many instruments of this type available on the "surplus" market (see recent articles on "Swords into Ploughshares") which are obtainable very cheaply, and are capable of being adapted for the purpose. Most of these instruments are, however, calibrated to deal with readings much lower than those of the engines to be tested, and it may be found desirable to equip them with reduction gearing, rather than attempting to alter the adjustment of the internal mechanism to raise the range of speed indicated. A worm reduction gear of 10 to 1 may easily be made and fitted, and has the advantage of enabling an instrument which only reads in one direction of rotation, to be applied to engines running either way, simply by providing a double-ended worm shaft. It is also unnecessary to alter the dial markings when a 10 to 1 reduction gear is used—just add a nought to the end of the reading. Automobile speedometers generally call for re-calibration of the dial when used for direct application to the engine.

A good deal of attention is at present centred around a simple form of speed indicating device now on the market, the principle of which has often been applied in the laboratory, though the idea of producing it commercially in a simple and compact form appears to have originated comparatively recently in America. It does not need to be driven from the engine, but is simply brought into contact with the structure, and is really a means of measuring vibration frequency by the resonance or sympathetic vibration of a tuned reed. The latter is provided with a sliding gauge, which adjusts its free length or period, and is calibrated in terms of vibration frequency. In use, the slide is adjusted until the maximum amplitude of vibration is shown by the reed, and the reading on the scale is taken as the measure of the speed. Apart from the advantage which this device offers in taking no power from the engine shaft, so that its application does not affect load or speed, its merit as an accurate speed indicating device is somewhat dubious, though there is no doubt whatever of its usefulness and convenience for general purposes. It is usually taken for granted that vibration of an engine structure will synchronise with the unbalanced forces which produce it, but this is by no means a foregone conclusion, and the effect of harmonic vibrations or natural periods of parts of the structure may seriously affect accuracy, or even render the readings entirely fictitious. In the case of a perfectly balanced engine, this form of "speed indicator" would obviously not record at all! I am of the opinion it would be far more useful in detecting the direction and amplitude of engine vibrations, with a view to enabling them to be eliminated or minimised by careful balancing.

An explanation of the working principles of speed indicating instruments and advice on adapting them to the purpose under discussion has recently been given in THE MODEL ENGINEER (see "Swords into Ploughshares"), so it is not necessary to deal with this matter in detail. However, the use of any direct-reading instrument of this type as an accurate means of measuring engine speed is open to question, and in my experience, errors are the rule rather than the exception, even with the most expensive instruments. All types are liable to faults in calibration or adjustment, apart from the possibility of slip



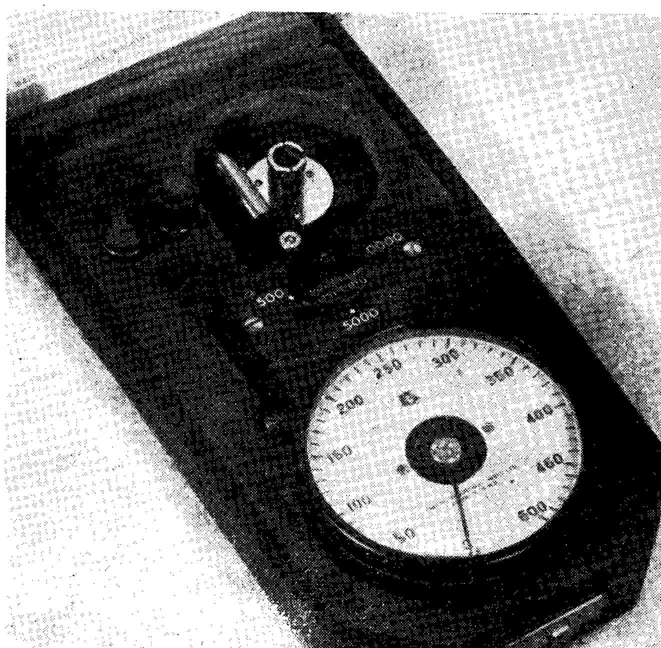
Starting up an engine mounted on a torque reaction balance

in the drive if taken by any other than positive means.

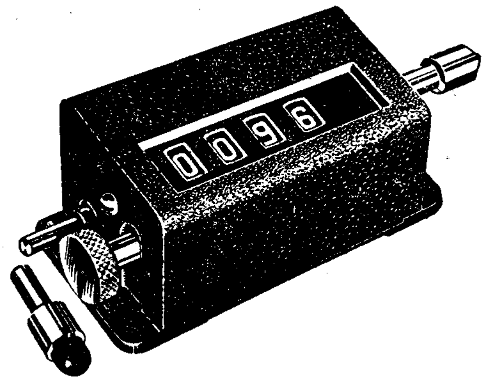
The most accurate direct recording speed indicator is a stroboscope controlled or synchronised by electric means, and this has the further advantage of operating without actual mechanical contact with the engine, so that it cannot possibly affect working conditions ; but is a most elaborate and expensive instrument, which will be beyond the resources of most amateur testers.

On the strength of some experience, I have no hesitation in saying that the most satisfactory means of obtaining a true record of engine speed is by actually counting the revolutions of the engine for a specified time. Counting devices of various types, from the primitive to the highly elaborate, are available nowadays at quite low prices, and are satisfactory if intelligently used, but the majority of these instruments are unsuited to direct application to high-speed mechanism ; the count wheels and gears are usually die-cast in zinc alloy, and will disintegrate rapidly if run at speeds commonly obtained with small i.c. engines.

The logical course is to run them at lower speed through reduction gearing, and here again, the 10 to 1 worm gearing will be found extremely useful. It is also a great advantage to incorporate some form of disengaging device in the drive. The usual arrangement is a simple form of dog clutch, normally held in disengagement by a spring but engaged by endwise movement of the shaft. Free running with the very minimum of effort is, of course, essential when using these counters on small engines, and wherever possible, positive means of driving them from the engine should be provided, rather than relying on the drive obtained through a friction tip. It may be objected that a geared-down counter with a 10 to 1 ration will only record to the nearest ten revolutions, but this is closer than can be obtained with most tachometers at high speed, and an ungeared counter might easily be liable to at least as large an error by over-run as a result of momentum. At a speed of, say, 5,000 r.p.m., ten



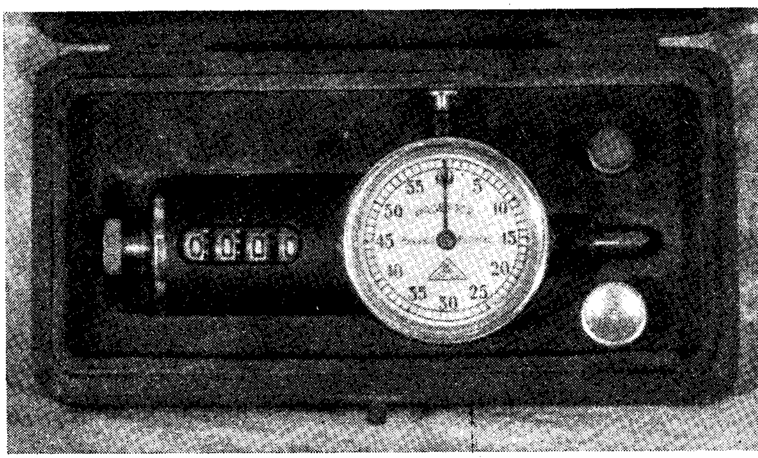
The Smith "A.T." hand tachometer, giving direct readings up to 50,000 r.p.m.



be mainly intended as ornaments, and do not record one minute per revolution as marked. I know of a case where a nurse timed a patient's pulse by means of her wrist-watch, and promptly (but quite prematurely) put in emergency calls to the doctor, solicitor and relations as a result of the erroneous reading! It is not invariably necessary to count the revolutions for a full minute's run, but some definite fraction of a minute is obviously desirable, and in my opinion, runs of less than fifteen seconds are of dubious value.

Some years ago, a combined counter and stop-watch, operated simultaneously by a clutch, was obtainable, but I cannot say if it is still on the market. The watch mechanism was automatically wound from the counter and could be set back to

(Above) *The "Trumeter" hand counter, with set-back adjustment and double-ended shaft for application to engines rotating in either direction*



(Right) *The "Probator" combined stop-watch and engine counter*

revolutions represent a discrepancy of only 0.2 per cent., by no means a considerable error.

In use, the counter is engaged with the engine for a specified length of time, which may be measured with a stop-watch if available, but if not, any watch fitted with a seconds dial, or even a grandfather clock will serve! A word of caution, however, is necessary; some watch or clock second dials (not always the cheapest) appear to

zero by a press button. The counter also had a set-back adjustment. It may here be noted that in cases where the counter has no provision of this nature incorporated, a note must be made of the reading each time before starting to make a test, and the difference between this figure and the final reading represents the actual number of revolutions recorded.

(To be continued

For the Bookshelf

Lathe Devices: Their Construction and Use. By Ian Bradley and N. F. Hallows. (London: Chapman and Hall Limited.) Price 12s. 6d. Postage 6d.

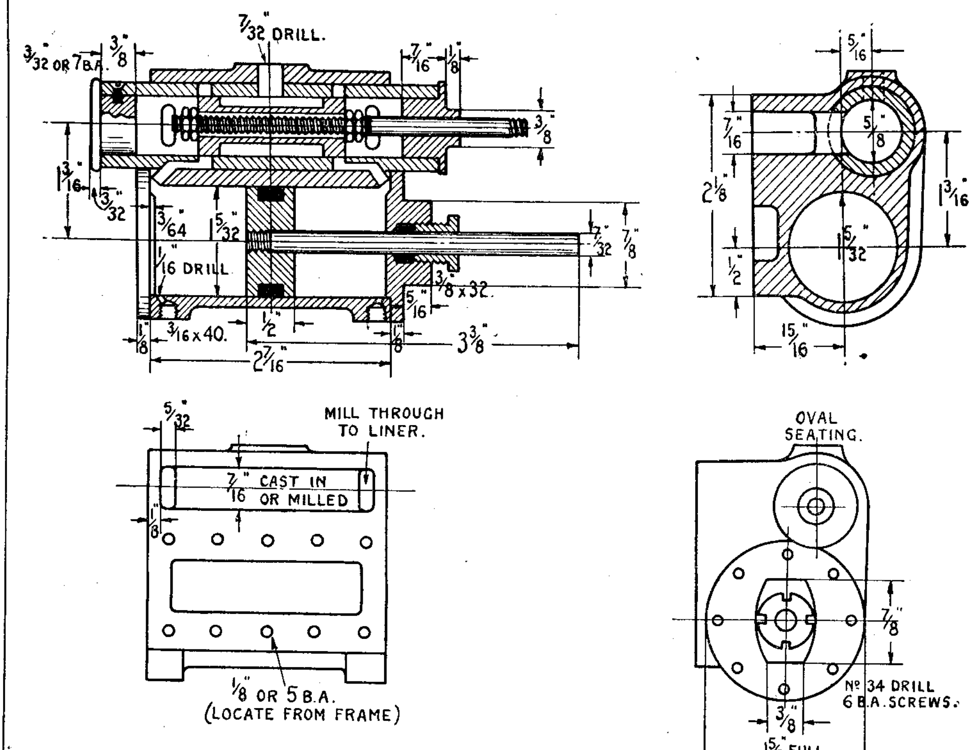
Readers of this journal will hardly need to be reminded to what extent the usefulness and versatility of the lathe can be improved by the addition of more or less simple fixtures and appliances. Many such have been described in THE MODEL ENGINEER, but their variety is never exhausted, nor can any limit ever be set upon their scope of application. The simpler forms of these appliances are described in THE MODEL ENGINEER handbook, *Lathe Accessories*, but in the book at present under review the authors (one of whom at least is well known to our readers) have dealt with the subject in greater detail, and have also included many other and in some cases more elaborate devices, mostly of their own design and construction.

Chapters are included on the devices for normal processes of lathe work, and also for dividing, milling, gearcutting, shaping and slotting; the two concluding chapters deal respectively with repetition work, and with tool forms and methods of sharpening. The illustrations are excellent, and comprise 135 line drawings. This is definitely one of the books which no model engineer or conscientious machinist should be without.

A $3\frac{1}{2}$-in. Gauge L.M.S. Class 5 Loco.

by "L.B.S.C."

SO, brother beginners, you *still* think that proper piston-valve cylinders as fitted to the full-sized L.M.S. class 5 locomotives, are difficult to make? Somehow or other, I have an idea that after you have read, marked, learned and inwardly digested (as we used to say at school) the following simple instructions on how to do the job, you will completely alter your opinion. In my early days, when anybody started in to tell me "Oh, you can't do that, it's too difficult," it made me eager to get on with the job, and do it; and to quote an early-Victorian phrase which formed a part of every letter, "I hope this finds you the same." Everything is easy *when you know how*; and here is the "how."



Sections, back and end views of cylinders for "Doris"

First of all, take a good look at the reproduced drawings. You will see that the job is reduced to the rockbottom of simplicity. There are no exhaust passages to drill in the cylinder casting, as I have substituted a cast-in "entrance to the way out." There are no long steam-passages in which to break your all-too-precious-and-expensive drills; and there are no arrays of studs to fit, for securing a separate steam-chest, very few holes to drill and tap, no ports to mill or chip, and no flat valves to file up. The whole job is simply a matter of careful boring and turning; and as for the piston-valve being difficult to fit to the liner, it isn't any more difficult than turning the piston to fit the cylinder bore. In fact, if your $\frac{5}{8}$-in. reamer is anything like accurate, and the casting merchants supply a bit of $\frac{5}{8}$-in. ground rustless steel for the valves, you won't even have to bother about turning the valves to fit the liner. If you haven't a reamer, there is nothing at all to worry about, either; all you will have to do, is just to bore out the liner to suit the valves, and run a D-bit through after pressing home.

How to Machine the Casting

First check off the coreholes. If the centres are to the given measurements, no marking out is necessary; if not, smooth off one end with a file, plug the ends of the coreholes with bits of wood, and mark the correct centres on them, striking out the circles for bores and liners from these centres. For beginners' benefit I might repeat that an excellent marking-out fluid can be made by dissolving shellac in methylated spirit, and adding some violet or blue dye. Brushed lightly

over the work, it dries in a couple of minutes, and scribed lines stand out very clearly. If there are any bumps on the bolting face of the casting, smooth them off with a file, and set up the casting by fixing it on a small angle-plate bolted to the faceplate ; a bar across its back, with a bolt at each end going through the slots in the angle-plate, will do the needful. Adjust the angle-plate on the faceplate until the corehole for the main bore, or the scribed circle as the case may be, runs truly. When the lathe mandrel is revolved, the edge of the corehole, or scribed circle, should run true to the point of a tool in the slide-rest, set 37/64 in. from lathe centres, or to the needle of a scribing block standing on the lathe bed. The casting should slightly overhang the edge of the angle-plate.

If you have a Keats angle-plate, you're in clover, as all you do is to drop the casting in the vee, tighten the clamp, and adjust the angle-plate on the faceplate till the corehole or scribed circle runs truly. I have one, and it saves a great deal of precious time. With the ordinary angle-plate the casting must also be set in line with the lathe bed, by applying a try-square, stock to the faceplate, and blade to the casting ; but the Keats gadget locates it automatically.

With a round-nose tool set crosswise in the rest, if the coreholes are true, you can face off the end of the casting. If working to marked circles, face off a part a little bigger than the finished bore, leaving the second circle showing, as you'll need it to reset the casting for boring the hole for the liner. Should the lathe vibrate and set up an "O" gauge earthquake when running, bolt a counterweight to the faceplate, opposite to the angle-plate ; anything handy will do, I use a couple of change wheels or an old cast-iron pulley. Set up an ordinary boring tool in the slide-rest, and bore out the casting ; if you have a 1 5/32-in. parallel reamer, bore out until the "lead" end will just enter. If you haven't (not many amateur locomotive builders have one this size, and they cost a tidy bit at present prices) bore to finished size, using the inside jaws of a slide gauge, or a pair of inside calipers set to a steel rule, to get the correct diameter. Take the last two cuts without shifting the cross-slide, which will allow for any spring in the tool, and ensure a true bore. Beginners should bore to 1/64 in. of finished size, and then regrind the tool, as they will probably take the sharp edge off when taking the first cut and removing the skin from inside the core hole. The first cut should always be pretty deep.

If the lathe has self-acting feed, or is screw-cutting, use the auto feed, and set the wheels for the finest possible traverse. If only a plain lathe is available, set the top-slide to turn parallel before starting operations on the cylinders. Chuck a piece of rod in the three-jaw, and take a light cut along it. Try with a "mike" or calipers, and if there is less than 0.001 in. difference in diameter at each end of a $2\frac{1}{2}$ in. cut, or if you cannot detect any difference in the feel of the calipers applied at each end, the top-slide is O.K. for the boring job. If not, adjust and try again until it is.

After finishing the main bore, shift the angle-plate bodily on the faceplate until the corehole, or marked circle for the liner bore, runs truly ; then repeat the boring operation, until the hole is $\frac{7}{8}$ in. diameter, or the "lead" end of a $\frac{7}{8}$ in. parallel reamer will enter, if you have one. Face off the end of the casting right across, after finishing the second bore ; then chuck a stub of brass rod in the three-jaw, turn it until the cylinder will just push on very tightly, mount it thus, and face off the other end with a round-nose tool, until the length of the casting is $2\frac{7}{16}$ in.

Steam and Exhaust Ways

You'll soon realise that the steam and exhaust ways in these cylinders are vastly easier to form, than the ports and passages in an ordinary slide-valve cylinder. File a flat on the lip of each main bore, make three or four centre pops on it, and drill $\frac{1}{8}$-in. holes slightly on an angle, into the steam-chest bore ; see longitudinal section. Run them into a slot with a rat-tail file, and scrape off any burrs. The exhaust ways are formed with a 5/32-in. end-mill or slot drill. My home-made slot drills, described several times, cut far easier and quicker than commercial end-mills. Put the cutter in the three-jaw, then up-end the casting on the slide-rest or saddle, packing it up so that the end of the exhaust recess comes level with the cutter. Then feed the casting on to the cutter with the longitudinal traverse, and work the cross-slide until the cutter has formed a passage $\frac{7}{16}$ in. long, from the end of the recess, into the steam-chest bore, as shown in the illustrations. The exact location doesn't matter ; it has nothing to do with the valve setting. Incidentally, this job provides another instance of the usefulness of a vertical slide, when a milling machine is not available ; a vertical slide should form part of the regular equipment of every home-workshop lathe. With an angle-plate attached to it, and the casting mounted end-up and secured by a bolt through the bore, with a big washer under the nut, the bolting face of the cylinder being set at right-angles to the bed of the lathe, both the exhaust ways could be milled out at one setting, using the vertical adjustment provided by the slide, to bring each end of the recess level with the cutter in the chuck.

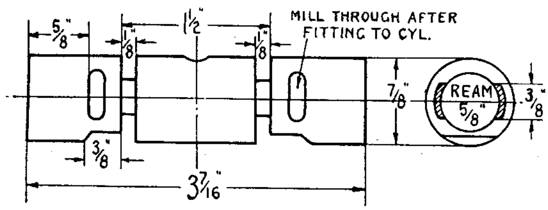
The two slots can, of course, be formed by drilling holes from the recess into the bore, and running them into a slot with a rat-tail file, but the end-milling process is far less laborious !

All piston-valve cylinders need drain cocks, to release trapped condensate water when starting from cold, so drill a 5/32-in. blind hole at $\frac{3}{16}$ in. from each end of the cylinder, in the bottom of the flange, as shown ; then from the ends of this, drill a $\frac{1}{16}$-in. hole slantwise into the cylinder bore, scraping off any burrs. Tap the blind hole $\frac{3}{16}$-in. by 40. Finally, face off the little boss on top of the steam-chest—a file will do that—and drill a 7/32-in. hole in the middle, for the steam inlet ; then put the angle-plate on the faceplate again, up-end the casting on it, securing with a long bolt and washer as mentioned above, and setting the bolting face at right-angles to the lathe centres. With a round-nose tool set crosswise in the rest, machine off the bolting face until it is exactly 23/64 in. from the edge of the main bore. This brings the centre-line of the bore to the correct distance from the frame, viz. $\frac{15}{16}$ in. as shown in the illustrations.

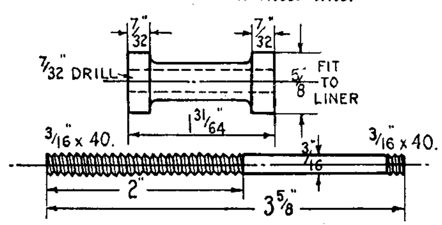
Cylinder Covers

Little need be said about the covers, as they are

the same as those on slide-valve cylinders, and I have described the *modus operandi* umpteen times already. The front covers are chucked by spigot provided, faced off, register turned to fit cylinder bore, and flange faced ; turn to diameter, part or saw off the chucking piece, rechuck either by gripping edge in three-jaw, or in a stepped ring with a saw-cut in it, held in three-jaw, and face off the outside, leaving the cover $\frac{1}{8}$ in. thick.



Steam-chest liner



Piston-valve and spindle

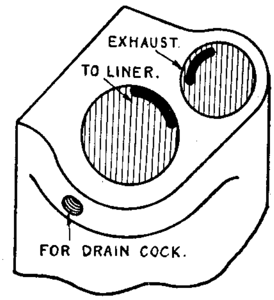
In the case of the back covers, the register, flange, and diameter are turned precisely as above, but the register should be an exact fit in the bore ; then centre, and drill 7/32 in. or No. 2, clean through the lot. Cut off the spigot, reverse in chuck, face off as much of the outside as you can without cutting into the gland boss, then face that off too, leaving it projecting $\frac{5}{16}$ in. beyond the cover. Open out the hole to 11/32 in. diameter for $\frac{3}{8}$ in. depth—it is advisable to use a pin-drill for this, for if the holes are not concentric, the gland will screw in " all wonky " as the kiddies would say (I'd far rather hear a kiddy explain things than any radio announcer or professional orator !) and the gland will bind on the piston-rod. Tap $\frac{3}{8}$ in. by 32, and make a gland to suit, from a bit of $\frac{3}{8}$-in. bronze rod ; a job that needs no detailing. The threads should be a good fit, so that the glands cannot work out when the engine is converting miles into minutes. Ream the hole 7/32 in., as the piston-rod should be a nice sliding fit in the gland.

The guide-bar seatings at top and bottom of the gland boss can be end-milled off in the same way as the sides of the axleboxes ; just clamp the cover under the slide-rest tool-holder, packed up to correct height, and traverse across a $\frac{3}{8}$ in. or larger end-mill or slot-drill held in the three-jaw. The part of the cover that could not be turned, can be hand filed ; a little job to test your ability to get a nice finish by hand work.

Eight No. 34 screwholes are drilled in each cover, as shown in the end view. You should know by this time, how to use the holes in covers to locate the screwholes in the flange, which are drilled No. 44 and tapped 6-B.A. The flats for the guide-bars must be at right-angles to the bolting face, so lay the cylinder, bolting face down, on the lathe bed or something equally flat, put a try-square beside it, and adjust the cover until the flats touch the blade for their full length ; the work of a few seconds only.

Piston and Rod

These are also the same as for slide-valve cylinders. The piston-rods are merely $3\frac{3}{8}$ in. lengths of 7/32-in. ground rustless steel, with $\frac{1}{4}$ in. of 7/32 in. by 40 thread put on one end. Hold rod in chuck, and screw with die in tailstock holder, true threads being essential.



Steam and exhaust ways

The pistons are made from either cast or drawn bronze rod, any diameter available over $1\frac{3}{16}$ in. Chuck in three-jaw, face the end, centre, and drill down about $1\frac{1}{4}$ in. with $\frac{3}{16}$-in. drill. Turn down about $1\frac{1}{4}$ in. of the outside to a shade over 1 5/32 in. diameter, say about 1/64 in. bigger ; then rough out a groove $\frac{1}{4}$ in. wide and a little over $\frac{1}{8}$ in. deep, with a parting tool. Part off $\frac{1}{2}$ in. full from the end, and " ditto repeato " for piston No. 2. Chuck one of the roughed-out pistons in the three-jaw, open the centre hole for a $\frac{1}{4}$ in. depth with No. 3 drill, and tap the rest 7/32 in. by 40. Put one of the piston-rods in the tailstock chuck, thread outwards ; run it up to piston, enter it, and pull the lathe belt by hand, letting the tailstock slide, until the rod is right home, with $\frac{1}{4}$ in. of the plain part drawn into the piston. I have detailed this out again especially for beginners, and would remind them that this is absolutely the best way I know of, to ensure the piston being true on the rod ; it is similar to the manner in which chucks are fitted to precision lathes, both my Milnes and Boley having this system.

Finish-turn the piston on its own rod by chucking a bit of $\frac{1}{2}$-in. brass rod, about $\frac{3}{4}$ in. long, in three-jaw. Centre, and drill through with No. 5 drill, and either ream 7/32 in. or bore out the hole with a weeny boring tool made from the tang of a file, or a D-bit, until the piston-rod fits exactly. Make a dot opposite No. 1 jaw, remove bush, split it down one side with a fine hacksaw, replace in original position, put a piston-rod in, and tighten chuck. The rod should run dead true. Turn the piston very carefully, a mere scrape at a time, until it will just slide into the cylinder bore, and skim off the end to bring the piston to exact length. Note : if you are going to ream the cylinder bores, don't finish-turn the pistons until this is done.

Steam-chest Liners

The casting merchants should be able to supply the liner castings long enough to allow for chucking and machining the lot at one setting. Chuck in three-jaw, face the end carefully, and bore out exactly the same as you bored the cylinder, until the "lead" end of a $\frac{5}{8}$ in. parallel reamer will just enter. Run up the tailstock centre, and let it support the end of the casting whilst you rough-turn the outside to about 1/64 in. over $\frac{7}{8}$ in. diameter. Now the relations of "Mona Lott" say that it is exceedingly difficult to turn the liner to a press fit in the cylinder casting; don't you believe it! Proceed like this: turn down $\frac{1}{8}$ in. of the end, same as the pistons, until it is a very tight fit in the hole in the cylinder casting. Use the casting itself for a gauge. Now turn the cross-slide handle half-a-revolution back, and bring it forward again to within one division of its original position. With that setting, take a cut along the outside of the liner. Then move the handle half a division further, and take another cut. The liner should then be exact to size for pressing in. If your cross-slide has no divided collar, you will have to judge the amount, but it is quite easy, you'll see for yourself how much to allow, far better than I can tell you, when you have turned the $\frac{1}{8}$ in. to enter the bore tightly. Leave the $\frac{1}{8}$ in. of "fit" on the end of the liner, to start it truly in the bore; part off at a bare $3\frac{1}{2}$ in. from the end, then rechuck the liner and face off to dead length.

At 31/32 in. from each end, form a groove $\frac{1}{16}$ in. deep with a $\frac{1}{8}$ in. parting tool; then mill or file away the bottom of these grooves straight across, so as to cut into the bore of the liner at top and bottom, leaving a bridge $\frac{3}{8}$ in. wide between the openings. See illustration of liner, which shows them clearly. These openings form the ports, and I fancy you'll agree that they are far more easy to locate and cut, than ordinary ports on a flat face. Now file away $\frac{3}{8}$ in. of the underside of the liner at each end, starting from the outside edge of the port, cutting away a full $\frac{1}{16}$ in. depth, and finishing the end on the slant, as shown; you'll also agree that this is easier than drilling several small holes to a great depth with a small drill. Finally, enter the reduced end of the liner into the cylinder casting, taking care to line up the filed-away portions underneath, with the sausage-shaped passages at each end of the main bore. Squeeze the liner right home, using the bench vice as a press (you can wangle a wider jaw opening by removing the steel inset jaws) and inserting a block of metal with a hole about $\frac{11}{16}$ in. diameter in it, between the casting and the vice jaw, to allow the liner to come right through the cylinder-block. Each end should stand out $\frac{1}{2}$ in.

Should any beginner slip up on the above simple job, and turn the liner too easy a fit for pressing home, don't worry! Simply tin over the outside of the liner, anoint the inside of the steam-chest bore with a drop of Baker's fluid, or other good liquid soldering flux, insert the liner, then heat up the casting steadily until the solder melts and seals the joint.

Poke a $\frac{5}{8}$-in. parallel reamer clean through the liner, holding the casting in the bench vice, and letting the reamer kind of "float" in your hand. A tap-wrench on the shank will drive it. The cylinder bore can be done at the same time if you have a reamer big enough. Set up the cylinder again same as you did when milling the exhaust ways, and continue milling them right through into the liner bore; or drill and file if you prefer. Also put the 7/32-in. drill down the steam inlet, and carry on into the liner bore. Clean off any burrs by running the reamer through again.

The little covers for the ends of the liner are simple turning jobs needing no detailed description, and can be turned from a bit of 1-in. rod held in the three-jaw. Turn down $\frac{3}{8}$ in. length to a push-fit in the liner. The front one is parted off $\frac{1}{2}$ in. from the end, reversed in the chuck, and the end turned as shown. Ditto repeato first operation for the back covers, then centre, drill down about $\frac{3}{4}$ in. depth with No. 14 drill, part off $\frac{9}{16}$ in. from the end, reverse in chuck, turn to outline shown, and poke a $\frac{3}{16}$-in. parallel reamer through the hole. No gland is needed; there is only exhaust pressure to withstand, and that is precious little on any of my engines. The covers will not fall out if they are held by two or three 3/32-in. or 7-B.A. screws put through the liner into the spigot of the cover, as shown in the longitudinal section of the cylinder.

Piston-valves

Try a piece of $\frac{5}{8}$ in. ground rustless steel in the liner. If it just slides in nicely with no suspicion of shake, you can use it as it is, for the piston-valves. Chuck in the three-jaw, face the end, centre, and drill a 7/32 in. hole just over $1\frac{1}{2}$-in. deep. Bring up the tailstock centre to support the piece whilst you form the reduced part between the bobbins. Make a cut with a parting tool $1\frac{1}{2}$ in. from the end; then turn away the middle to $\frac{3}{8}$ in. diameter with a round-nose tool, leaving a bobbin exactly 7/32 in. long at each end. Part off at $1\frac{1}{2}$ in. then rechuck and take a weeny cleaning-up skim off each end, so that the finished valve is 1/64 in. under $1\frac{1}{2}$ in. long. Did I hear somebody murmur something about piston-valves being difficult to make, and requiring precision grinding machines and so on?

The valves can also be made from bronze. Turn down a length held in the chuck, to a little over $\frac{5}{8}$ in. diameter, for $1\frac{5}{8}$ in. length, then proceed exactly as above; but before parting off, skim down the two bobbins, "scrape by scrape" in a manner of speaking, until they just slide in the liner, like the piston in the cylinder bore. Then part off, and finish to length as above.

The valve spindle is a $3\frac{5}{8}$ in. length of $\frac{3}{16}$ in. rustless steel or drawn bronze rod, with 2 in. of $\frac{3}{16}$ in. by 40 thread on one end, and about $\frac{3}{16}$ in. of same pitch on the other. The valve is held between two pairs of locknuts which you can easily make from $\frac{1}{4}$ in. hexagon brass rod, no detailed instructions being necessary for that simple job; the valve must be free to turn, but must not have end-play. The assembly is shown in the illustration; pack the pistons and glands with graphited yarn, and put oiled paper gaskets between the cylinder covers and casting.

Brother locomotive builders—do you really, honestly, and truly, as my only niece used to say in her schoolgirl days, now think that piston-valve cylinders are difficult to make?

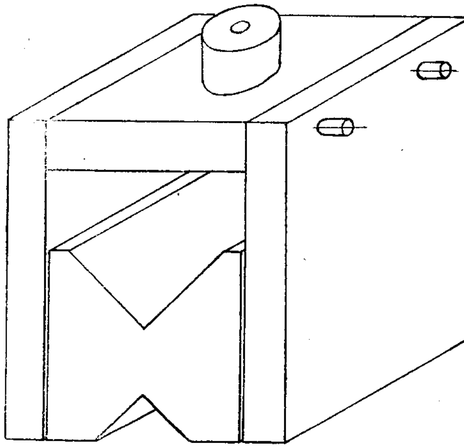
Radial Drilling of Round Bars

by H. V. Eddy

TO ensure true radial drilling of bar in the vee-block under drilling machine, the little jig shown was constructed.

It is simplicity itself to make and does ensure that the hole is started at top (or 12 o'clock) and that it will come out at "6 o'clock."

It is made around a standard vee-block, any small one will do, but the one used was a B and S, measuring 2 in. × $1\frac{1}{2}$ in. × $1\frac{1}{2}$ in.

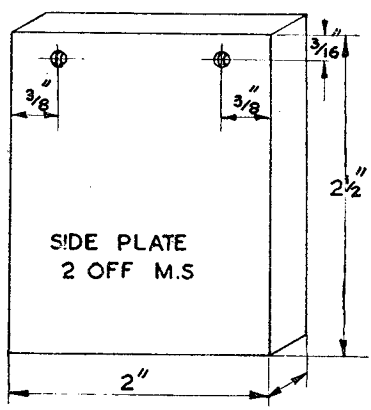


Sketch of the jig

Construction

The parts to make are side plates and top plate, and the bush of tool steel, as shown in sketches.

Cut out and "square up" the two side-pieces from $\frac{1}{4}$-in. M.S. plate ; scribe off $\frac{3}{16}$ in. from top and pip $\frac{3}{8}$ in. from each end—remember two of these plates are required. Now cut out of $\frac{3}{8}$-in. M.S. the top plate 2 in. × $1\frac{1}{2}$ in. "plus a bit," and it is this "bit" that matters.



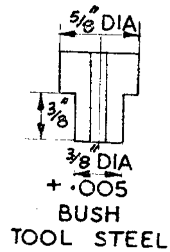
The top is filed up until it will fit between the side members and just allow vee-block to slide snugly in between sides—this is the essential fit.

Assembly

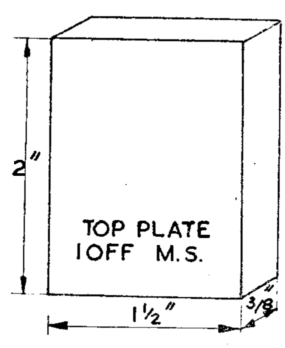
At this stage of affairs clamp up the lot as it will appear when assembled, turn on side, tap drill No. 25 drill (in both sides) running drill into top plate to depth of $\frac{3}{8}$ in., tap $\frac{3}{16}$ in. B.S.F., and screw up with countersunk-headed studs. This makes a neat-looking job.

Fix right way up on drill press, and accurately pop centre of top—this must be carefully done to ensure drill coming through to line with vee underneath—drill through $\frac{1}{8}$ in., follow with $\frac{3}{8}$-in. drill.

Make bush of tool-steel by turning up in lathe ; make stem 5 thou. oversize for $\frac{3}{8}$ in., drill right through $\frac{1}{8}$ in., part off and harden.



Now with adjustable reamer, ream out centre hole in top plate easily, bit by bit, and press in bush, it need not be extremely tight, just a good press-in fit.



The jig is used in starting a hole with the $\frac{1}{8}$-in. drill. If larger hole is required, it is easily removed from vee-block to allo w the larger c to follow up.

Milling on a Drilling Machine

by Kyrle W. Williams

STRANGE to say, the Engineering Department of a Naval Base during the war rarely offered much scope for resourcefulness, as the R.N. engineer does not seem inclined to run his own workshop, and prefers to leave the sort of job that delights the owner of a repair shop in peace time, to the dockyard or civilian repair works.

The writer found this very much the case in the early days of his period of service in the R.N.V.R., but when he came to be a Base Engineer Officer himself, he found, as he had many

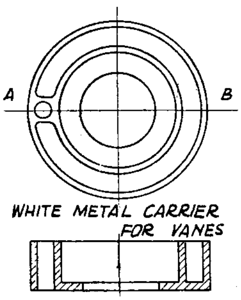


Fig. 1

times found before in Civvy Street, that there is nothing like having a shot at jobs beyond the scope of the Base to stimulate keenness in the staff. The result at the writer's base was that quite a number of good jobs were done in record time with machine tools definitely not intended for the purpose.

During the busiest period of Combined Operations development, it was essential that completion dates of refits should be kept "to the hour." Again and again completion would be prejudiced, not by work on the main engines so much as by the lack of some small part required for an essential auxiliary service. In this connection, bilge and ballast pumps were old offenders.

One of the worst headaches came from the lack of certain parts cast in salt-water-resisting white-metal and machined all over. The machining included the cutting of a circumferential slot on one face; this slot, however, being interrupted by a rectangular boss with a hole drilled through it. Fig. 1 is a diagrammatic view of the part in question.

When one is refitting major landing craft in a restricted harbour with a "four ring" Captain, R.N., requiring reasons in writing for delays in completion, it will be appreciated that you cannot excuse yourself on the grounds of non-delivery of a white-metal part weighing about 1 lb., while the problem of machining an interrupted, blind-bottomed slot with the choice of a 4-in. lathe and a pillar drilling-machine on which to do the recessing is a bit of a problem.

The proplem was solved, and a number of

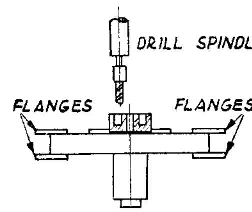


Fig. 3

these parts machined, by using both lathe and drill in combination. The table of the drilling-machine was swung off centre so as to bring the spindle over the white-metal block at the required distance from the centre. It will now be appreciated that by feeding the spindle down by hand, to put the cut on, and rotating the table, the slot can be formed. By fitting stops on the table, and a corresponding stop on the drilling-machine pillar, rotation can be restricted so that a space can be left from which to form the boss.

It was found, however, that hand feeding was not good enough, even after attaching an extension handle to the table, and the 4-in. lathe was,

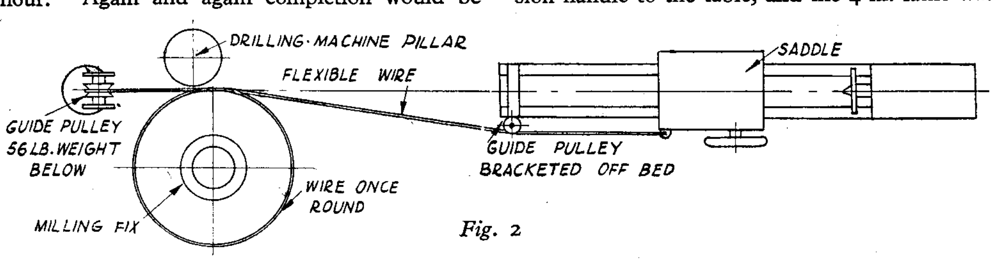


Fig. 2

therefore, roped in to provide a power feed. To effect this the periphery of the drilling-machine table was turned into a pulley by bolting rims made of sheet-steel above and below by means of bolts passing through the slots. Unevennesses below the table were packed up with wood. A turn of flexible wire about the thickness of sash-cord was taken round the table edge, and clipped to the table at a point that coincided with the centre of the boss when the latter was clipped down in position.

One end of this wire was then led over a pulley

(*Continued on page* 50)

*The Story of "Centaur"

by J. I. Austen-Walton

THE brake-valve feeding the system contains a number of parts and, in outward appearance has the " Westinghouse " look as opposed to the more usual vacuum control with perforated front plate. This control works on the reducing-valve principle so that, as the handle is moved through its arc of movement from the " brakes held " position to the " emergency full on," there is a corresponding and constant increase in pressure. Furthermore, this pressure is maintained according to the position of the handle, for the reducing-valve makes up losses due to condensation and leakage quite automatically. I fitted the " live " side of the system with a pressure gauge, and it is interesting to watch the effect of this maintained control. A movement of the control handle from " brakes held " to the " brakes off " position in the opposite direction operates an independent cam for freeing the system to atmosphere.

The trunk pipe to the tender feeds a separate and independent brake-cylinder for this unit ; but in this there is no provision for vacuum control, and the cylinder is single acting with a spring return. Like the prototype, a hand-brake control is mounted vertically on the front tender bulkhead, and operates the same brake shoes *via* bevel-gears and a slotted link to prevent one form of operation interfering with the other. As a matter of interest only, the opposite hand-wheel normally operating the water pick-up is connected to a large water-control valve, so that with a tender full of water, it can be separated, from the engine without having to lose the water. For making small adjustments where this separation is necessary, I have found the fitment invaluable. The indicator, normally used to denote the water contents of the tender, is connected to the control valve and is used to show the " on " and " off " position of the valve.

Seeing that I have strayed away to the tender, it would be as well to outline its principal points. The frames follow real practice and are double, and these " insoles " carry the spacers and brake-arm carriers. Still harping on the brake-gear, the rods are all compensated back from stage to stage with separate " bottle screw " adjustments for each side.

With only 40 *lb. on the clock* !

The tender body contains a separate silver-soldered copper tank with baffle-plates inserted to prevent " swirl," and is removable *en bloc* by freeing one large union at the front end. At the back and open end, and bolted to a reinforcing pad underneath the tank, is the emergency water-pump which is much too small in bore and stroke, as it happens, and due for replacement at any time now.

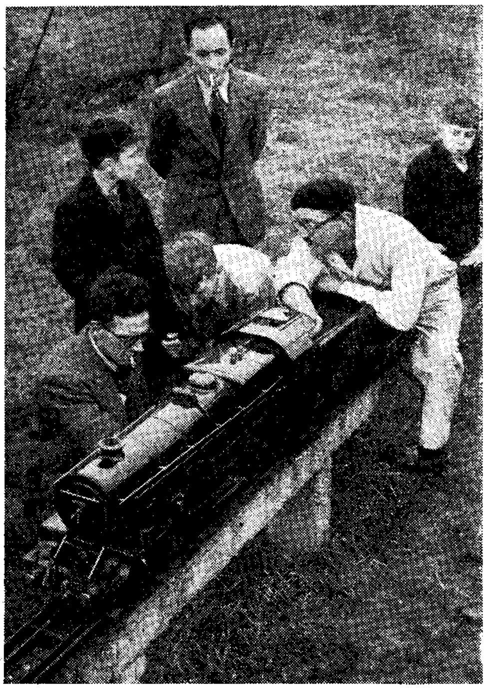
The pump suction is led to a large " strum," or strainer, which also serves the main feed to the engine. Purely as a fad, the inside of the tank is enamelled white, giving a clean and neat appearance at all times. The whole of the back platform over the tank lifts out for cleaning and pump access, and is fitted with the characteristic adornments of filler lid (working) and vent pipes and deflector dome (dummy).

The forward bulkhead, coal doors and toolbox slide out in one piece, but the coal doors latch and fold in correct style, and the toolbox opens and could be used to contain miniature tools. With the exception of the fire-irons—pricker, rake and shovel, all in stainless steel and much over scale, for obvious reasons—there

* *Continued from page* 17, " *M.E.*," *July* 1, 1948.

is nothing much else to note on the tender itself.

The roof of the cab is held down with small knurled "captive" screws, and is fitted with a sliding hatch on top. For driving, it has never been found necessary to remove the top, and, with the hatch open, all the valves on the fountain can readily be seen. The centre of the fountain carries the whistle-valve, which is cord-operated and saves burnt fingers. Incidentally, steam from this valve goes forward to a scale dummy whistle that emits a silent puff of steam, whilst a larger pipe runs to a man-sized whistle or hooter about 10 in. long, and situated under the tender. So far, this has failed to produce anything more than a hoarse whisper! I suspect the extra long pipe for this failure, for the whistle, when separately tested, produced a perfect L.M.S. low note sound (quite by accident). But some solution will no doubt be found.



A check-up on the injectors

The floor of the cab is metal with separate teak planks screwed on from underneath, and the entire floor and hinged flap lift out in one piece. Windows, all with removable bolted-on frames, are glazed with $\frac{1}{16}$ in. Perspex, and the gloomy forebodings of the pessimists who described the crinkly and gelatinous mess that would one day adorn the cab floor have failed to materialise. As a direct opposite, these windows, in spite of the heat, have retained their transparency and flatness, and leave nothing to be desired.

All the valve hand-wheels are three-spoked, of rather delicate section and made in stainless steel. Rather to my surprise, they do not get too hot to hold. Their polished rims might, however, be improved by the addition of tiny spikes to assist finger grip.

Two injectors are fitted, one working (by chance only) on a low-pressure range, i.e. 0-60 lb., and the other on 60-150 lb. Neither injector has yet failed to work, but I must admit to feeling suspicious of the little brutes, in spite of the claims of those more expert in the matter of small injectors.

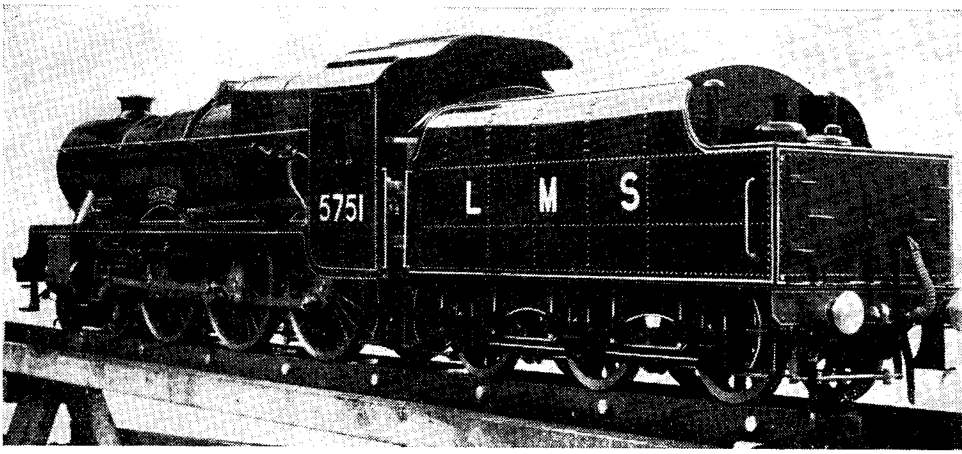
In this connection I have had a suspicious mind from the beginning. So provision has been made for the fitting of a good and hefty twin-cylinder donkey-pump to be situated under the cab floor. An exhaust-pipe runs from here to join up with the main exhaust header in the smokebox, and a separate water-feed and valve await the pleasure of doing their connected service.

And now I come to the all important question of paint finish, lining, lettering and fancy trimming. I believe that most models are spoiled, or partially spoiled, through indifferent painting and lining, and it might be heartening for my readers to digest the fact that I am no expert in these matters. I did, however, approach the problem with a serious and spare-nothing attitude. I feel that I started right by getting the best obtainable stoving primer, surfacer and finishing enamel. With the aid of a baby spray-gun of reliable make and a home-made electrically-heated oven, complete with thermometer—to say nothing of the paint-maker's stoving temperature instructions—I set to work.

Well, I did what I thought was right and obtained a result that was only fair. The second attempt was successful, and later made more so by the simple expedient of doing much work rubbing down and polishing. The final result as seen is, in fact, not perfect and I admit having yet much to learn. It so happens that the true L.M.S. red is a most difficult colour to manage, having certain qualities of transparency that call for meticulous handling and finishing of the undercoats. In addition to this difficulty, the colour is what is known as "fugitive" and has the property of changing in intensity where there is any variation in the stoving temperature. That is why the black finish has turned out to be the most satisfactory and already the emphasis on gloss is wearing down with weathering and cleaning—that is desirable.

The lining out, in the straight-line areas, has been done with transfers, whilst the curved portions have been matched in with a lining "pencil." I would prefer not to describe the various forms of anguish I suffered when performing these antics. I happen to know that the lining should have been "gold colour" and not gold-leaf. But, there you are! I offer no excuse!

Of the gold-leaf lettering on the tender sheets and the numbering on the cab sides, I could tell an even more bitter story. Suffice to say that I now have a formula of sorts showing that for every sheet of gold-leaf used on the engine at least five must be allowed for general and mural decoration! In passing, I might add that a lathe and milling machine part-gilded, although presenting a gay and festive appearance, are not



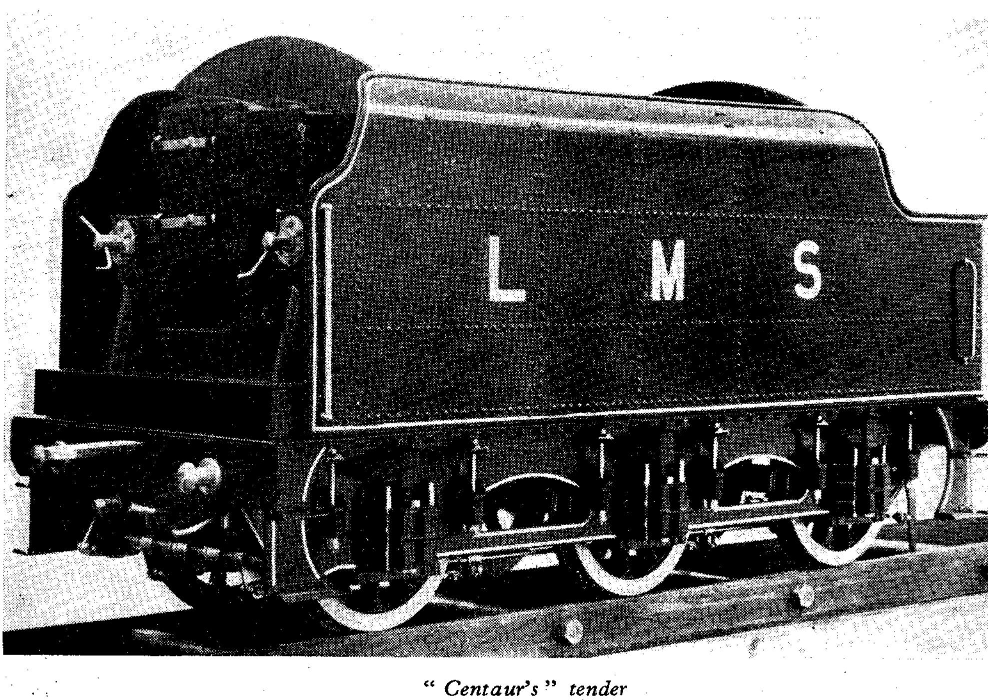
The usual "station view"

quite a practical proposition and should not be indulged in seriously.

And so to the trimmings—little things like chequered steps and treads. These are not "clever" as some misguided persons have purred to me, and anyone fool enough to stand for hours and hours at a milling machine cutting diagonal lines, one by one, in stainless steel is welcome. And probably certifiable!

Hooks and couplings, in this case all stainless, are, in a sense, less trivial, and attention to exact scale and proportions is worth while always. But taking an overall view of *Centaur*, I have benefited by the comments, criticisms and scraps of praise that have come in from many sources, and have weighed evidence for evidence and point for point with surprising and satisfying results.

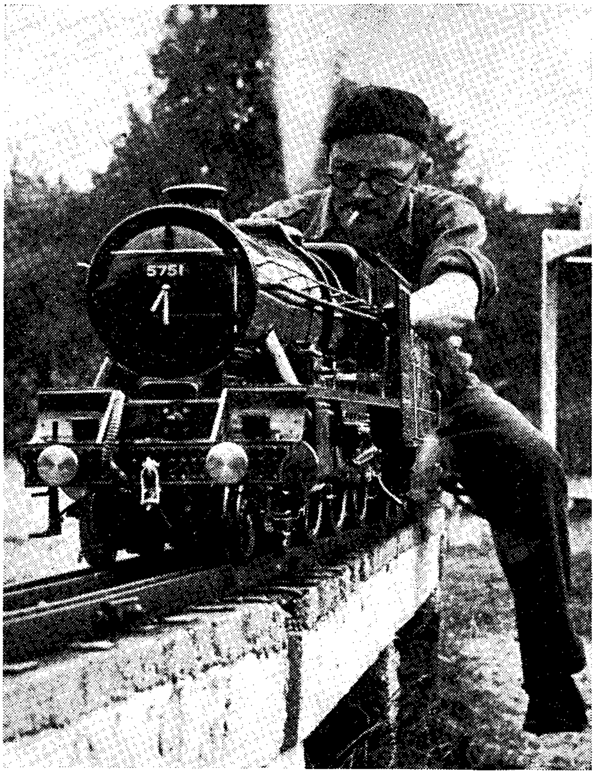
I would like to quote one or two examples. I would venture to say that something like a controversy has raged over the question of the short-sided tender, and in the early days it looked



"Centaur's" tender

as though the critics were right. In point of fact, the tender itself is dead right and true to scale, but the engine cab roof is high. This is due to structural points hinging on the pitch of the boiler above the frames necessary for clearances over moving parts more than the overscaling of the boiler as a unit.

Since the engine has been on the track and has covered 120 actual miles odd, she has had quite a few drivers other than myself, and all who have driven have seen and felt the need for the adjustments made. I would agree that a $3\frac{1}{2}$-in. gauge engine would need no such drastic cutting down, but on a 5-in. job the reach over the tender is greater and matters of personal balance come into the picture. It is a fact that, seated on the driving truck, it is impossible to lean forward to the controls without lifting the rear end of the driving truck. For this reason alone I have never yet driven *Centaur* solo.



The moment we dream about!

As a result of this interesting survey, I can now safely say that, from the practical point of view, more people are in favour of the design than are against it from the purely visual aspect.

Am I satisfied with *Centaur*? Frankly, no, but that, I contend, is natural. We all learn from our own efforts that we forever chase that elusive state of contentment. As an engine, a stepping stone, a landmark— yes. And there is no condition or reservation that I am able to add.

Milling on a Drilling Machine

(*Continued from page* 47)

and terminated in a 56-lb. weight. The other end was led through a snatch block, and attached to the saddle of the 4-in. lathe. It so happened that the circumference of the drilling-machine table was slightly less than the full traverse of the lathe saddle. Therefore, it is obvious that if the mid-position of the saddle corresponded with the mid-position of the drilling-machine table, everything could be tightened up ready for work.

The other workshop lathe was worked day and night, and by so doing kept the supply of turned blanks up to requirements. These blanks were clipped down on to a fix, and three holes drilled at the radius of the slot. Two of these were drilled to the depth of the slot for clearance purposes and the third was drilled right through the future boss. A jig was used to drill through, and the casting was subsequently located by means of a peg dropped through the centre hole.

The slot was roughed out with a fly-cutter of the type used for cutting keyways, and finished with an end-mill. The feed, as will have been noticed, was put on by means of the hand feed of the drilling-machine, while the traverse was achieved by simply engaging the " sliding " lever on the lathe. The 56-lb. weight kept the traverse steady in one direction, while in the reverse direction it acted as " the power behind the traverse " while the saddle took on the job of steadying.

The " Lash up " so briefly described is illustrated in a diagrammatic manner in Fig. 2. It did the job, mainly, of course, because the drilling-machine was a new one and the fit of the table spindle in its socket in the arm was accurate. It is felt, however, that many workshop owners have a lathe and a drilling-machine, and, maybe, they have milling jobs, or shaped jobs that are beyond the faceplate or lathe chuck. In such cases, some adaptation of the scheme outlined might bring a happy issue out of all their afflictions.

Editor's Correspondence

A Magnetic Clock Escapement

DEAR SIR,—I read with great interest the article on the above subject by Edgar T. Westbury in your issue of May 27th.

While it must be agreed that the escapement described is very ingenious, and will almost certainly give excellent results for ordinary purposes, I would like to point out that it is very far from being as perfect as Mr. Westbury would have us believe.

The principle is equivalent to driving the pendulum by a crank through a connecting-rod, or by a harmonic cam. The only essential difference being that instead of mechanical links a magnetic field is used. This certainly eliminates friction, but friction is not the objection to such a principle.

In order to make use of the isochronous properties of a pendulum it is essential that the pendulum be allowed to swing completely free for as great a part of its period as possible.

In the magnetic escapement described, the pendulum is at no time free from the influence of the driving train, and it is therefore obvious that, so long as the mechanism does not slip, which, of course, it should not do, any variation in the driving torque will lead to a corresponding variation in the period of the pendulum.

In fact, just how fast or slow the pendulum can be made to swing by increasing or decreasing the torque of the train is limited only by the failure of the star wheel to perform the function for which it was designed.

Any escapement which allows a variation in driving torque to influence the period of a pendulum or balance-wheel is useless for high precision time keeping.

Yours faithfully,

Reading. T. C. MOORSHEAD.

Hunting Traction Engines

DEAR SIR,—My recent article in THE MODEL ENGINEER has brought me in so many letters that I have not been able to reply to all of them individually, or to accept all the kind invitations from your readers to inspect and operate engines they know about. I would, therefore, like to say how grateful I am for the interest shown by the writers of these letters and for the interesting information contained therein. I now know of many more traction engines which I shall try to visit as time and Mr. Gaitskell permit.

For instance, from Eythorne comes news of a Mann, actually a road-roller, which, I am assured, receives the attention usually reserved for a newly-born baby! It rolls cricket pitches in the spring and drives workshop machinery and a circular wood saw during the rest of the year, being fitted with a Pickering governor, and a small Mumford donkey-pump bolted to the near-side bunker plate, for the latter purpose.

A "mutual lover of steam" reports two Burrell engines, alas, due to the broken up, in Hampshire, and another letter informs me that a contractor's yard near Middlewitch contains nine engines, including Burrell, Fowler, Foden, etc., and that at Foden's own works at Sandbach are several very nicely preserved Foden traction engines.

On the same note, I learn that a fairground proprietor in Lancashire has several engines in regular use, while someone else says he recalls that the "Lincoln Imp," which I mentioned, was as long ago as 1920 used by a roundabout firm. An engineer at Horsmonden tells me that he has two Marshalls, a Clayton, four Avelings, two Burrells and a Fowler ploughing engine in his yard and that he recently saw an 1868 Fowler ploughing engine, No. 1908, running as well as the day it was made.

A letter from a model engineer brings the good news that he has nearly finished a $1\frac{1}{8}$-in. scale model traction engine, mainly of Fowler design, and is now occupied with making complete $2\frac{1}{4}$-in. scale working drawings of a Tasker "Little Giant" 5-ton engine, preparatory to commencing a model of one. Data are being obtained from two such engines, in a yard in Buckinghamshire, where, also, is a 5-ton Fowler with wooden rear wheels.

Then a gentleman not unknown to me in the world of fast motor cars enquires if I have noticed a compound piston-valve traction engine, believed to be an Aveling, beyond the timing hut at Prescott, where the racing cars deport themselves. Although I have hardly missed a single meeting at Prescott since the hill was opened, I have to confess this engine escaped me! The same correspondent refers to a weird engine on the moors of South Shropshire which has its cylinder sunk in its boiler, and the crankshaft located above the cylinder and driven by a Scotch crank mechanism.

Finally, news is to hand of a 7 h.p. Clayton single, a 6 h.p. Foden, a Foden timber tractor, a Foden wagon converted into an agricultural traction engine and the Foden Showman's Locomotive, "Morning Star."

It is all most interesting and I tender my sincere thanks to these and other correspondents. Clearly, the love of steam is as strong as ever it was.

Yours faithfully,

Fleet, Hampshire. W. BODDY.

Hot-Air Engines

DEAR SIR,—I have been very interested in the article by "B.C.J.", and the subsequent correspondence on the subject of hot-air engines.

My object in writing is to submit the view that, in their search for a higher thermal efficiency, designers have been led away from the only real claim to consideration of this form of power unit, which is its convenience. Under this heading I include—low first cost, simplicity of operation and maintenance, reliability, and capacity to use any fuel which will burn in a furnace. In small sizes these advantages might often outweigh a relatively high fuel consumption.

With these ideas in mind I propose the following general arrangement :—

(1) An engine following standard internal combustion practice, with a cylinder and

piston arranged to compress a fresh charge of cold air at each cycle.

(2) The compression space to be separate from the working cylinder and in the form of a heated chamber, liberally finned both inside and out, to transfer heat from the furnace to the working charge of air.

That a surprising amount of heat can be transferred through a suitably finned wall is shown by modern air-cooled aircraft engines, which commonly transmit as much as the equivalent of 60 H.P. in this way, per cylinder.

The heat cycle would, of course, be a rather poor approximation to that of an ordinary petrol engine. Even so, I suggest that, given a little experimenting to find the optimum compression ratio, and the most suitable arrangement of internal fins to take full advantage of the turbulence of the compressed charge, sufficient power could probably be obtained to justify small machines for users who have no electricity, and who require less than the 2-3 b.h.p. which seems to be the lower useful limit for commercial petrol engines.

Yours faithfully,

Wellington, N.Z. P. W. HECTOR.

Club Announcements

The Society of Model and Experimental Engineers

The next meeting of the society will be held at Caxton Hall, Westminster, S.W.1, at 2.30 p.m. on July 17th next, and will be devoted to lecturettes by members. No meetings will be held in August.

Hon. Secretary: E. L. ASHTON, 20, Pollards Hill West, Norbury, S.W.16.

Sale Model and Engineering Club

The above club's exhibition was held in the clubroom on Saturday, June 12th, and was highly successful. About eighty different exhibits were on show of various types. The cup for the best model completed during the year was awarded to Mr. F. C. Griffiths for his 30-in. yacht with Mr. J. H. S. Williams's driving unit for a coal conveyor model, and Mr. A. Walker's 2 ft. yacht runners-up. The cup was presented by the president, Councillor F. H. Highley. All proceeds from the exhibition were given to the Sunshine Homes for Blind Babies.

Hon. Secretary: J. H. S. WILLIAMS, 154, Park Road, Timperley, Cheshire.

Handley Page Model Engineering Society

The above society has now formed a "Live Steam" section and as a combined effort it is proposed to build a 5-in. gauge locomotive of the L.M.S. 2F class. The trestles for a 66 ft. portable track are nearly complete, and as soon as material is available a start will be made on the permanent way.

Other activities recently have included model aircraft control-line flying and model car racing on the track at Cool Oak Lane, Hendon. Facilities are available here for non-members to run models at certain times and written application should be made to the Hon. Secretary, H. W. G. CROOKS, c/o H.P. Sports Club, 40, Claremont Road, Cricklewood, London, N.W.2.

Reading Society of Model Engineers

At our last meeting Mr. T. Large gave an interesting talk on "Weighing Apparatus" which was illustrated by well prepared drawings.

A 3½ in. lathe has been loaned to the society and it is planned to give elementary instruction to those who desire it.

Hon. Secretary: J. SHAYLER, 14, Westwood Road, Tilehurst, Reading, Berks.

Hull and District Society of Model and Experimental Engineers

Instead of an annual dinner and social, the Hull society recently had a club outing, and over thirty members visited York Railway Museum and Locomotive Sheds. This turned out to be a very interesting event. Old-time engines, such as G.N., G.W. and L.B. & S.C., were well inspected and club photographer, Mr. S. Jennison, was kept very busy. Engines of all types were well looked over. The new "Peppercorn Pacifics" aroused great interest and it was a really impressive sight to see the Thompson rebuilt Pacific *Tehran* slipping and kicking up a terrific din when trying to move the *Scotsman*.

The society wish to tender their best thanks to Mr. Harry Clarkson of Selby, for his assistance in obtaining permission for us to view the sheds and for explaining many details we should have missed without him.

Assistant Secretary: R. MIDDLEBROOKE, 19, Seaton Grove, North Road, Hull.

The Rochdale Society of Model and Experimental Engineers

The above society are holding their first exhibition during October this year. A comprehensive display of models, some working, will be on show together with a passenger-carrying track. A number of local tradespeople have agreed to provide displays of materials and tools. This is a preliminary announcement only. Further details will be given at a later date. If there are any "lone hands" in the district who are interested and would be willing to exhibit, please get in touch with the Exhibition Secretary, W. F. JACKSON, 11, Crosby Street, Rochdale.

Hon. Secretary: D. WOOLFENDEN, 21, Vicarage Road, Castleton, Rochdale.

Proposed Club for Southport

Initial steps in the formation of a model engineering club in Southport have now been taken following a meeting between a Southport modelmaker and Alderman S. E. Charlton, chairman of the Publicity and Attractions Committee.

Following the publication in the *Southport Visitor* of his suggestion that a miniature boat regatta should be staged here, the model fan discussed his suggestion with Alderman Charlton. Alderman Charlton has offered his support to the proposal that an exhibition should be held in Southport and a model engineering club formed. This club would be of great value to the youth of Southport and offer them a recreation which is clean, healthy and educative. Full support and co-operation is expected of all those interested in the youth of Southport.

All those interested in assisting and organising a regatta, exhibition and club, should contact Alderman Charlton, c/o *The Southport Visitor*.

Although Alderman Charlton was satisfied there is no money in the town for this type of sport, he is quite sure his committee will back the modellers because of the benefit and interest to young men and women of Southport. It is hoped to stage an exhibition this August, form a club, and eventually hold a model boat regatta on the Marine Lake, subject to co-operation from the Southport Boating Company.

One of the biggest problems will be the finding of suitable club premises.

Huddersfield Society of Model Engineers

The above society are holding an "At Home" at their Highfields Centre on July 10th, 1948.

Locomotives and boats will be welcome. Teas will be available.

Secretary: F. W. L. BOTTOMLEY, 763, Manchester Road, Huddersfield.

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Readers desiring to see the Editor personally can only do so by making an appointment in advance.

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